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EDITORIAL

PREVENTION OF MATERNAL DEATHS AS A MEDICAL PROBLEM

PROBABLY because it is difficult to hold the attention of the public for a very long time, the storm of criticism which followed publication of statistics showing a large number of maternal deaths to be preventable, has largely subsided. Some of the literature which the public was invited to read attained dizzy heights. When the "mothers of America" were told, in a publication having a very large circulation, to protest to their physician, their mayor, their governor, their congressman, their president, the peak of demoralizing propaganda was reached. The public should know the facts, of course, but the gap between information and knowledge is so wide that only the medical profession can bridge it. Propaganda hurts the cause, and of itself will surely increase our death rate.

The situation, however, grows more acute. The report of the Committee on Findings of the recent Washington Conference on Better Care for Mothers and Babies, and the new proposal for a national health program of the Interdepartmental Committee to Coördinate Health and Welfare Activities have been presented to the President of the United States. These clouds are much bigger than a man's hand. Not propaganda this time, but active governmental interest and participation.

The President has been told that during the last twenty-two years, except for a slight decrease in deaths due to toxemia, there has been but little decline in maternal mortality; that deaths associated with delivery have shown scarcely any decrease; deaths from hemorrhage have declined slightly; deaths from sepsis, which account for more than 40 per cent of all maternal deaths, and which are largely preventable, have shown no significant decline. The Conference finds that "immediate and concerted national consideration and national action is warranted," that progress

toward its objectives can be made by better undergraduate education, better graduate educational facilities, adequate training of specialists, better distribution of competent physicians, greater facilities for education of physicians in hospitals caring for maternal cases, and the development of a complete obstetric service under state and federal control, in urban and rural areas far and wide. I have not quoted from the discussion of stillbirths or other fetal mortality, because this lies beyond the scope of this editorial, but obviously, this is an important part of any maternal welfare program.

With the exception of the proposal for a national obstetric service to be paid for by taxes, there is nothing new here, nor, so far as I can see, can any considerable progress be made this way for a very long time. Undergraduate education is as good now as it can be. No revision of the curriculum, no possible increase in the number of student deliveries will help the medical school to prepare its graduates for much more than management of normal cases; instruction in prenatal care is good now, yet it suffers in application. Obstetrics is an art which not even practice makes perfect. Too often internship endows the young physician with confidence which is ruinous without experience. It is true that there is much hope for the future in the new graduate education program of the National Boards and the American College of Surgeons; and we feel that postgraduate courses are desirable, but they can do little more than the medical school unless actual clinical experience is included.

Today the bulk of our obstetrics is done in the hospital. Three-quarters of all births in cities with a population of 10,000 or over occur in hospitals. In 1937 in the City of New York 89 per cent of all births were hospital deliveries. Why look farther for a place in which to carry on postgraduate education?

On the other hand, only about 14 per cent of rural births take place in the hospital, so that there is a different and more difficult problem in thinly settled sections of the country. Perhaps that problem can wait a little until hospitals are provided. Certainly all primiparas should be delivered in the hospital. It may be spectacular to send a doctor or a nurse many miles to a home delivery, but transportation of the patient to a hospital is much more sensible. Aside from the time-worn discussion as to the relative merits of home and hospital delivery, there is a rapidly growing demand for institutional treatment. In planning for the future, public health authorities will do well to recognize this trend, which is very definite indeed.

Although mortality is higher in cities it does not follow that the increased rates are due to the hospital, since two important factors in the higher urban rate are the larger number of abortions in the city, and the deaths in urban hospitals of women who were delivered in rural areas. No large scale unbiased comparisons are available. If it can be said that the patient's very presence in a hospital invites operative delivery, that is too bad; she should, of course, be assured of every advantage and comfort, certain that her physician is well prepared for any emergency, able to exercise his best skill and judgment unprejudiced by the clamor of insistent relatives.

Whether large or small, hospitals may be good, bad or indifferent. They have a very definite obligation in prevention of maternal mortality and morbidity, for responsibility for the patient's welfare does not rest entirely with the doctor. If the hospital is not safe, it can be made so. Women have a right to expect this, and the best interests of patient, physician and hospital are served in no other way. The patient must be protected, and the physician must be supported by advice and help whether he wishes it or not. Yet nothing should ever be done to cause the patient to lose that confidence in her physician which is so essential.

Except for operative obstetrics, the every-day physician is probably the best practitioner of midwifery; his experience

will keep pace with knowledge as he multiplies his contacts with good conscientious obstetrics. This is the best kind of postgraduate education, quickly available without anyone leaving his home or practice to enjoy its advantages.

The general practitioner has been left to his own devices long enough. He has been forced to learn his obstetrics in the hard school of experience, but he will welcome help if it is tactfully offered. If proper consultants are not available, they can be made so. No doubt we shall have to consider that phase of the problem later. In hospitals with organized staffs, he should be given courtesy privileges and made to feel that he is an important part of the department of obstetrics. For example, the Brooklyn Committee on Maternal Welfare has requested every Brooklyn hospital to post the following notice in a conspicuous place near the delivery room:

"The members of the obstetrical staff will grant consultation willingly in all cases. Compensation for such consultation shall not be required except when the attending physician provides evidence that the patient can afford to pay for such service. The intern on duty will arrange for such consultation. All physicians attending obstetrical patients in this hospital shall be required to call a consultant from the obstetrical staff in all instances of:

"1. Prolonged labor—twenty-four hours or more without satisfactory progress.

"2. Operative deliveries except low forceps when caput is showing.

"3. Antepartum bleeding.

"4. Severe toxemia.

"Interns are not permitted to perform any obstetrical operation unless a member of the obstetrical staff is present."

We are all aware that analgesia and anesthesia, in spite of their more or less natural corollary, operative delivery, are in great demand. More and more women insist upon relief from the pangs of childbirth. This is just as much a trend as their desire for hospital delivery. True, we are not all of one mind as to the relative advantages of conservative and radical methods, but we are so involved at this time, that discussion is fruitless: neither side can be convinced. Possibly the new ideas have come to stay. We do agree, however, that only physicians who understand well the disadvantages of these modern methods, and are thoroughly able to cope with situations which may arise, should have anything to do with them.

Interference, whether indicated or not, is the commonest cause of puerperal infection, of which our knowledge is still far from perfect. The streptococcus is the usual cause; long labor, hemorrhage, toxic states and intervention are the commonly associated conditions. There have been cases in which no interference whatever had occurred, not even a rectal examination, but on the whole, autogenous infection is now known to be rare. Most infections by the hemolytic streptococcus are transferred from the nose and throat of anyone who attends or visits the patient during labor or afterward; the carrier with acute or recent infection is far more dangerous than anyone else. Since effective treatment consists largely of prevention, the importance of droplet infection can not be overemphasized. The new amendments to the Sanitary Code of the City of New York make limitation of visitors and general use of masks compulsory in every maternity hospital in the city—a great forward step which might well be imitated everywhere.

Although we do have to revise our ideas from time to time, it should be possible for us to agree upon basic standards. However, even the principles of prenatal care, which we all accept without question, do not receive general application. We know that the story of antepartum care has not reached thousands of women, and that other thousands who have had the gospel preached to them, pay no attention to it; even women with a history of repeated dystocia do not become interested until the last moment. That is not our responsibility. We do our best at public meetings now and then, but we alone cannot educate the public. It is discouraging to find, how-

ever, that a very large proportion of those who do register with a physician receive no prenatal examination whatever. The floating head in a primipara at term, the breech, the large fetus can, as a rule, be easily found on abdominal palpation; and it is much better to know the previous obstetrical experience of the multipara, than to wonder why she does not progress favorably in labor. Recognition of tuberculosis, diabetes and serious cardiac disease is important, not difficult, and calls for special advice and treatment if we are not qualified to give it. Certainly we should not fail to look upon hypertension as a serious complication, nor fail to impress upon the patient the importance of reporting toxic symptoms or even slight bleeding. Placenta previa and abruptio are formidable complications of pregnancy, and, like eclampsia, should not be managed by the general practitioner alone.

Abortions contribute heavily to our mortality rate—one-quarter of all maternal deaths, a fact to which the press might well pay attention. These figures need publicity. Since abortions are tending to increase in number, it is likely that the individual problems of women will keep their maternal death rate high for years to come. At least 60 per cent of abortions are self-induced. Women should be made aware of the risk they take. There is little that we can do about it, except to remember that even therapeutic abortion carries a high mortality, and that we should look upon curettage in septic abortion as a highly dangerous procedure. It is wise to consider all incomplete abortions septic and advise hospital treatment in all cases.

In early abortion we should always consider extra-uterine pregnancy a possibility; as failure to think of it most often defeats diagnosis. In ectopic gestation the inexpert operator had better not open the abdomen in the face of severe shock; it is better to await improvement and plan for transfusion. Nor should anyone perform incidental operations in the presence of intraperitoneal blood.

Version and forceps are more difficult to discuss briefly. Perhaps it is sufficient to say that successful version is far from easy, and in the primipara at least calls for more perfect art than cesarean section. Even skilful obstetricians approach forceps opertions with considerable deliberation and some trepidation.

Our cesarean mortality is terrific, accounting for approximately 7 per cent of all our maternal deaths, even as many as 27 per cent of all deaths associated with the puerperal state in one of our great cities. It is clear that the risk depends directly upon the number of vaginal examinations, the duration of labor particularly after rupture of the membranes, and attempts at vaginal delivery. Yet no one will deny that, even in the perfect case, danger of death from peritonitis and anesthesia cannot be eliminated. Spinal block is still the most dangerous anesthetic. Nor should we get the impression that the lower segment operation, which is rightly gaining in favor, is so much better than the classical, that it carries with it assurance of safety, even if there is no tangible evidence of infection present. Mortality in the low operations depends upon the same factors as in classical cesarean. Cesarean section is not for the novice or the interested-at-the-moment surgeon no matter how skilful he may be, for the risk is so great that all indications for the operation should be subjected to the most critical scrutiny.

Management of the third stage of labor, manual dilatation of the cervix or removal of the placenta, the absolute indications for transfusion or a host of other subjects might also be discussed in this connection, but this is not the place to carry on postgraduate education.

We should have in every large community or county a committee on analysis of maternal deaths. This should provide us with a nearly perfect mechanism for that postgraduate education which in the final analysis is the solution of the medical problem. Admission to its meetings should

be free to all members of the medical profession, with a card of admission required since questions involving legal responsibility may be discussed. Here the facts of actual deaths may be presented without identification of persons or hospitals, and all controllable factors then developed by frank and open discussion. No criteria for preventability need be set up other than those which develop about each individual problem. At these meetings, which I know will be popular, with real cases for text books, uncertainty will be reduced to the concrete by qualified obstetricians who may be present; they too will learn something to their advantage. The educational opportunity afforded by critical group review of actual problems of everyday practice is obvious.

Possibly publication of preventability percentages has gone far enough. They have served their purpose as a means to an end and will accomplish nothing more. Actually it is impossible to define preventability with any scientific exactness, for interpretation of human clinical data is never easy. The very word implies a criticism which is not intended, a certainty which only wisdom after the event could possibly guarantee.

We are dealing with a complex and difficult question which really depends for solution upon sociologic and economic factors almost completely beyond our control, but solution of the medical problem will be hastened by such a system of postgraduate education.

Charles A. Gordon, M.D.

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ORIGINAL ARTICLES

THE TOURNIQUET AND LOCAL ASPHYXIA*

FREDERICK M. ALLEN, M.D.

NEW YORK CITY

THE tourniquet is one of the oldest surgical devices, but apparently very little more is known concerning it now than was known several centuries ago. Only a trivial amount of research seems to have been performed concerning it, and a fruitful field of development has thus been missed. An investigation conducted by the writer for several years on local asphyxia has involved the application of tourniquets to large numbers of animals, and some of the observations may be of interest to surgeons as regards both technique and principles. It is best to discuss successively the local and constitutional effects of vascular stasis in the limbs.

LOCAL EFFECTS

Material of Tourniquet. An inelastic material, such as silk or metal, compresses or cuts through tissues up to a definite point; the only elasticity is that of the tissues themselves, and when they yield to the necessary degree the pressure of the ligature ceases. An elastic material, such as rubber, exerts continuous pressure, and even after it grooves the tissues by displacement of fluid or cells, the pressure does not cease. Nevertheless, the damage done by the inelastic material is far greater, so that for stopping circulation with any hope of subsequently restoring it, the elastic ligature is almost the only practical one. Under some conditions the elasticity of air compression may be even superior to rubber.

Relation to Character of Tissue. The word tourniquet implies a form of ligature which is applied to a mass of tissue, so that the circulation in the blood vessels is stopped by pressure of the surrounding tissues, which obviously constitute a pad for the vessels. Results therefore depend upon the composition not only of the ligature but also of the tissues. Tough tissues and large vessels are far more resistant than soft tissues and small vessels. For example, the leg of a rat readily survives several hours of compression by a rubber tourniquet, while a silk band tight enough to stop circulation for the same period generally causes thrombosis. If punctures are made, so as to place the tourniquet inside instead of outside the skin, the rubber band is apt to cause thrombosis, because of lack of the padding afforded by the tough skin. On the other hand, rubber bands can be applied tightly to various masses of exposed muscle in the dog or man with much greater impunity than in the rat, because the tissues are tougher and the vessels larger. Obviously similar differences prevail between the muscles and the different viscera. Practically the same fact may be expressed in the statement that tough tissues and large vessels will tolerate heavy ligatures tied more tightly, while soft tissues and small vessels require lighter ligatures tied with less pressure.

Form of Tourniquet. The commonest forms are rubber tubes or bands. If the bands are thin, they wrinkle and fold so as to lose breadth; therefore the usual broad tourniquet is also rather heavy. The current opinion among surgical authorities seems to be expressed by Auchinschloss,

* From Polyclinic Hospital, New York City.

who favors the gentle effects of broad compression, even using towels under the Esmarch band for increasing the breadth and padding. Narrow rubber tubes become embedded in a deep tissue groove and supposedly inflict greater trauma by their highly localized and intense pressure.

These views appear logical and rational. Nevertheless the prevailing custom seems to rest upon logic and opinion rather than upon proved facts, or at least it runs counter to two experimentally demonstrable facts: (1) Choosing the rat as an animal which readily responds to different methods of ligation with differences in thrombosis, it is found that the narrowest possible rubber tourniquet is the most harmless, while broad bands, or padding with cloth, or compression of the entire leg give the highest incidence of gangrene. (2) In practical use, e.g., for stopping circulation in the leg of a conscious human subject, narrow tubes cause much less complaint of pain than the typical broad heavy tourniquets.

Further investigation is doubtless needed concerning the protection of the skin by fabric, and especially the possible superiority of stasis produced by air compression. For the purposes of the present work at least, the narrow tourniquets of ordinary rubber tubing applied to the bare skin have seemed most satisfactory. The flaw in the customary logic seems to lie in the fact that the degree of pressure required to stop blood flow is not greatly different whether it is distributed over a wide or a narrow area; but tissues are injured chiefly by direct pressure, therefore the greater the extent of such pressure the greater is the injury.

Pain. Pain varies with the type of ligature, the tightness of application, and the character of the tissue. A rubber band around the leg tight enough to stop circulation apparently does not cause much suffering to a rat, as judged by the comparative ease of distracting the animal's attention from it, and by the small dose of a hypnotic which can produce sleep. On the contrary, any tourniquet which stops circulation in a dog's thigh seems extremely painful, as judged by the animal's behavior and by the very large doses of sodium amytal required to make it quiet. The feelings of other species are more difficult to judge, but apparently the rabbit reacts somewhat like the rat and the cat somewhat like the dog.

Apart from possible differences of nervous sensitiveness, the firmness of the tissues again appears as a probable important factor, the pressure on the hard tense muscles of the dog's thigh being more painful not only than compression of the rat's soft leg but also seemingly more painful than in the human leg.

The use of the tourniquet in man is very familiar and does not cause anything resembling the agony of arterial closure by embolism. The initial discomfort is easily tolerated by all except very nervous subjects, and before long the numbing of the nerves by pressure and asphyxia ends most or all of the pain. The importance of the type of tourniquet in this connection was mentioned before.

Local After Effects. Local circulatory stasis is followed by reactive hyperemia and all the phenomena of inflammation, which increase in intensity and duration in proportion to the duration of the stasis, up to the point where necrosis supervenes. The sequelae which are chiefly feared in human surgery are paralyses and contractures. As far as can be judged from animal experiments, conditions analogous to these clinical contractures are most apt to result from the extensive damage caused by broad or excessively tight tourniquets. In animals at least, the paralyses which result from narrow, properly applied ligatures are always temporary and end in complete recovery. Such paralyses vary in degree and duration, and may be functional or organic.

The conditions differ in different species. For example, the leg of a rat after ligation for half an hour is paralyzed, but this paralysis may disappear by the next day;

therefore the nerves could not have been destroyed. An hour of ligation causes paralysis which may persist for a week or more; while longer ligations, lasting several hours, result in paralysis lasting several weeks. In these latter cases the nerves were obviously destroyed, because the process of restoration can be traced from above downward, the sensory recovery being demonstrably more rapid than the motor. On the other hand, the leg of a dog, cat or rabbit is not paralyzed by a half-hour ligation, and there is no more than trivial or ephemeral paresis from ligations of as long as three to five hours.

One cause of the paralysis is plainly the necrosis of nerve fibers from direct pressure at the point of ligation, and it therefore appears logical that the large animals with tougher and better padded tissues should withstand pressure better than the small animals with soft tissues. Theoretical deductions, however, are often fallacious in this subject, as illustrated by two facts; (1) the tourniquets in the larger species are heavier and tighter, as nearly as possible in proportion to their size and toughness; (2) in another paper, positive proof will be furnished that the prolonged paralysis in rats after one to several hours of ligation still occurs when the factor of local tourniquet pressure is excluded. In other words, organic destruction of nerve fibers can result purely from local asphyxia.

Again it may seem logical or inevitable that nerves should be the most sensitive structures in the limb, to asphyxia as well as to other injuries. Here again, logic collides with the fact (as shown in the paper on nerve lesions[3]) that this sensitiveness belongs only to the nerve fibers while the peripheral ganglion cells are surprisingly resistant. It seems possible that the more rapid tissue metabolism of the rat may be an important factor in the earlier and more severe nerve injuries resulting from circulatory stasis. Application of observations in one species to another species being subject to errors, it remains uncertain whether proper technique in the application of the tourniquet can insure that any paralyses resulting from prolonged stasis shall be only temporary, as in animals; but at least this hope remains open.

Pressure Necrosis. Next to the nerves, the skin suffers most from tourniquet pressure, because of either its superficial position or its natural sensitiveness. Several series of experiments, attempting to produce either chronic edema or arterial lesions by daily repetitions of ligation, had to be abandoned because of skin ulcerations, even though the position of the ligature was changed each day.

A single very prolonged constriction, even with the best type of rubber tourniquet, causes ulceration at the zone of ligation. The time required is governed partly by the thickness and toughness of the skin in different species, being least in the rabbit, and progressively greater in the rat, cat and dog. In all these species, however, ligations of eight hours or longer are followed by ulcers of varying degree and extent in the zone subjected to the direct pressure of the tourniquet.

With the more severe degrees of damage the necrosis extends also into the muscles, while there is still no thrombosis in the large blood vessels or gangrene of the distal tissues. Severe ulceration may open the way to infection of the damaged parts, sometimes resulting in loss of the limb through secondary thrombosis or gangrene; or healing may leave scars and deformities such as do not result from uncomplicated local asphyxia. It remains to be determined whether these complications might be lessened by the use of an air-pressure cuff instead of a rubber tourniquet.

Survival Limits of Asphyxia in Limbs. This is a point on which most surgeons seem to be astonishingly uninformed. The article of Auchinschloss may again be taken as representative of prevailing ideas. He mentions that in an operation he once left a tourniquet in position for four and one-fourth hours without harm, as if this were something remarkable. The writer has found that the wing of a chicken can

tolerate a tourniquet for at least nine hours, the maximum limit being left undecided. The leg of a rat can recover after thirteen hours of sufficiently careful ligation. Evidently the tissues can withstand at least fifteen hours of asphyxia, because gangrene results merely from thrombosis or infection originating in the zone of ligation, and in some instances the leg is found to survive for a day or two before it is lost through these causes. The leg or tail of a dog can recover completely after fifteen hours of ligation. Here again, the damage at the zone of ligation prevents ascertaining accurately the true limits of local asphyxia which the tissues can endure. Wilson and Roome, who took particular care to assure complete stoppage of circulation, found absence of gangrene in the dog's leg after twenty hours, but as their animals died from incidental causes, their observations may be taken as representing the limit of survival of local asphyxia by the tissues, instead of the limit for complete recovery, which is shorter because of the complications.

There is no theoretical reason why human limbs should be any less resistant. On the contrary, it is probable that the activity of tissue metabolism is one of the important factors determining the survival limit, and because of the rapidity of metabolism this limit is likely to be shorter in the mouse, rat and chicken than in the dog, and perhaps shorter in the dog than in man. A few isolated examples indicate that human limbs are at least as resistant as those of animals.

Perhaps the most extreme instance is that mentioned by Cannon, from the material of the Shock Committee during the World War, of an officer whose thigh was crushed between logs for twenty-four hours. It seems evident that the stoppage of circulation was complete; otherwise the restoration of circulation would not have been followed within a few hours by death from shock. Particularly in view of the great influence of temperature, which will be described elsewhere, there is no reasonable doubt that if the weather was moderately cool a man's leg could survive twenty-four hours of complete absence of blood flow, provided that the damage in the zone of compression was not such as to cause thrombosis either primarily or secondarily. It is remarkable that under favorable conditions the blood in the asphyxiated limb remains liquid and the vessels remain patent so as to permit restoration of blood flow.

The misconceptions of surgeons concerning tolerance for local asphyxia probably arise chiefly from three causes: (1) They are usually dealing with damaged or diseased limbs and blood vessels, which are subnormal in resistance. (2) Prolonged asphyxia sets up correspondingly severe inflammation and reduction of tissue vitality, so that any existing wounds or infection are greatly aggravated and secondary gangrene can result. (3) Probably most important is the utterly irrational custom of warming the asphyxiated limb.

If there is retention of the minimal circulation necessary for the survival of the limb, warmth will presumably favor this circulation and is therefore proper, though serious attention should be given to the increased circulatory demand created by the acceleration of local metabolism. But when circulation is known to be absent or inadequate, as for example after embolism of the brachial or femoral artery, the use of warm coverings or warm applications to the limbs cannot be too strongly condemned. Wrong ideas and practice in regard to temperature are primarily responsible for the excessive timidity of surgeons in the use of the tourniquet, as well as for the current supposition that embolectomy must be performed within a time limit of about four hours after the embolism; for unnecessary aggravation of acute injuries and permanent sequelae; and for other harmful mistakes and limitations. These will be more fully explained in a paper devoted to the opposite plan—reduction of temperature.

As previously mentioned, extremely long ligations are always followed by paralysis; but on the other hand abundant experimental evidence seems to show that paralysis due solely to local asphyxia is always temporary. Effort should therefore be directed to prevention of damage in the zone of ligation, where permanent impairment is most apt to originate. In general, the great resistance of tissues to local asphyxia encourages the development of methods for avoiding unnecessary amputations of limbs.

Survival Limits of Asphyxia in Viscera. The viscera differ widely in resistance to asphyxia, but none of them can endure it for anywhere near as long a time as the limbs.

The most complete surgical information is available with regard to the intestine, and though some differences may exist between the different segments, there is nothing in animal experiments to conflict with the clinical belief that the survival time without blood supply is limited to six hours or less. The time in small animals is in fact much shorter, e.g., three or even two hours in the rat, presumably because of the more active metabolism. Because of the marked influence of temperature, it is theoretically probable that the survival time for the intestine and all other organs will be reduced in febrile patients.

The liver is highly sensitive to asphyxia. Tests of the entire organ are difficult because of the danger of shock. Ligations of individual lobes indicate that fatal damage may be done by lack of blood for one-half to one hour, at least in small animals, but the investigation was left incomplete.

The pancreas is notoriously one of the most dangerous organs to disturb. Clamping of its blood supply for as little as one-half hour, when the gland is in digestive activity and its cells full of zymogen, may result in death from fat necrosis. On the other hand, when an animal has been prepared by several days of fasting, so that the content of digestive ferments is low, it has been possible to clamp off the pancreas for as long as two hours without sloughing or fatality. This experiment furnishes an example of differing sensitiveness, for asphyxia selectively damages the pancreatic islands in comparison with the acinar tissue. Therefore, as the writer showed (1919–1922) an animal with a large mass of remaining pancreatic tissue, many times the amount required to prevent diabetes, can be made diabetic by a series of clampings of the pancreatic vessels. In autopsies weeks or months later, the large pancreas remnant is found to consist of expanses of apparently normal acinar tissue without islands.

The adrenals are apparently very sensitive to asphyxia. Though this investigation did not include any definite tests of them, it seems theoretically probable that the cortex and medulla differ in resistance, and that one or the other might be selectively destroyed by a suitable period of asphyxia, thus obviating the need for separation by surgical dissection.

The spleen ranks rather high in resistance. In the dog it can evidently withstand four hours of clamping and possibly more. In the rat its survival period was fixed by numerous experiments at barely more than three hours, while four-hour asphyxia caused sloughing. The tests differed from those of the preceding organs, in that the spleen after clamping of its vessels was allowed to lie just outside the body, in contact with it and covered with warm wet gauze, but yet presumably at a temperature lower than that inside the peritoneum. Thrombosis is perhaps the principal cause of gangrene with ligations beyond three hours. The longest ligations, not followed by acute necrosis, cause comparatively slight sclerosis and leave the organ evidently quite efficient functionally.

The kidney vessels of rats were clamped in the same manner as those of the spleen, with approximately the same results as regards acute gangrene. The subsequent course presented a very sharp difference, inasmuch as the kidney underwent marked atrophy after asphyxia of as little as one

hour, and after the longer ligations it was reduced to a functionless sclerotic nodule. A series of authors, dating back almost to the earliest times of experimentation, have used temporary clamping as a means of studying degeneration in the kidney parenchyma. The writer and Loesch were the first to produce chronic hypertension in experimental animals, by brief (twenty to thirty minute) clampings of the renal vessels continued during several months. According to the quantity and function of the remaining kidney tissue, it was possible to produce gradations ranging from a state resembling essential hypertension, to severe chronic nephritis ending in uremia.

The testis of the rat can survive three or sometimes four hours of asphyxia without gangrene, though the clamping of both testes for this period sometimes causes death from shock. The severe acute inflammation and subsequent atrophy rank the testis among the highly sensitive organs. Clamping for less than one hour causes considerable damage. Clamping for one hour causes extensive atrophy, and sterilizes the rat as proved by subsequent breeding tests. Any longer clampings reduce the testis to a small nodule of fibrous tissue and altered remains of ducts.

As previously mentioned, the nervous system presents one of the most extreme contrasts, since the cells of the principal centers in brain and cord are known to die after brief deprivation of blood, while the cells of the peripheral ganglia can withstand asphyxia for a number of hours.

CONSTITUTIONAL EFFECTS

While a tourniquet remains on a limb, constitutional effects are absent or slight. After its release, the local inflammation and edema are accompanied by the typical phenomena of secondary shock. This form of shock is well known clinically, and has been used by a number of investigators for study of the shock problem in animals. The writer, from a large experience with this method,[4] formed the opinion that it furnishes the optimum material for research on secondary shock, for definite reasons, namely: the reproduction of all the characteristic local and constitutional symptoms, the absence of pain and the nervous causes of primary shock, the accuracy of gradation and control, the absence of dead or dying masses of tissue or blood, the adaptability to therapeutic tests, and the possibility of complete recovery under proper conditions.

After sufficiently long ligation, the exudate of plasma-like fluid not only accumulates in the limb but also overflows it for various distances along the groin or abdomen. There is also evidence of passage of fluid out of the vessels elsewhere, probably throughout the whole body. Authors who have studied this phenomenon have mostly given attention to proving that the quantity of the exudate suffices to account for the diminished volume and increased concentration of the blood, so that the symptoms and death are thus accounted for on a purely physical basis. The correctness and the great value of these investigations is recognized, and only a minority of workers cling to the older theory of a chemical or toxic origin of secondary shock. The present writer, though not attempting to identify a toxin, in the paper mentioned, reported indirect evidence strongly favoring the existence of such a toxin, which apparently occurs chiefly in the tissues and is not present in large quantities in the blood at any one time. It seems to furnish the most plausible explanation of all the phenomena of shock, including the fluid exudation itself.

Most of the experimental findings cannot be recapitulated here, but a few applications to clinical surgery can be pointed out. The necessity of precise definitions should be emphasized. Aside from terms such as collapse, prostration, etc., which have a descriptive rather than a physiologic meaning, the four principal conditions which may merge and pass into one another, but yet are fundamentally dis-

tinct in nature, are summarily definable as follows: *Hemorrhage* is loss of circulating fluid and cells. *Primary shock* is the early nervous and vasomotor effect of injury by mechanical, thermal, chemical or other agencies. *Secondary shock* is distinguished by the passage of fluid from the vessels into the tissues, whether the total fluid content of the body be diminished, increased or unchanged. *Dehydration* is loss of fluid from the body, illustrated in extreme form in cholera and diabetic acidosis.

The surgical applications above mentioned pertain to the production and the treatment of secondary shock.

PRODUCTION OF SHOCK

The production of shock by the tourniquet can be standardized with fair accuracy for any animal species along two lines, namely extensive and intensive. It is self-evident that the more extensive the mass of tissue injured, the greater will be the shock. As an example of standardization along this line, the ligation of one entire hind leg of a rat for three hours is never fatal, but the ligation of two hind legs for three hours is fatal, and still more severe shock results from asphyxia of the entire hindquarters by ligation of the lower abdominal aorta.

More intensive injury is produced when the identical tissue mass is ligated for increasing lengths of time. For example, asphyxia of one hind leg of a rat for four hours may be fatal and for five hours is invariably fatal; when continued longer, up to eight, ten or twelve hours, it does not cause local tissue necrosis, but does produce a more severe and more rapidly fatal degree of shock. Therefore the survival limits of the local tissues can never be learned by means of a tourniquet around the thigh, but only by one placed well below the knee. In other words the increased intensiveness must be counterbalanced by diminished extensiveness, the mass of ligated tissue being so small that even the longest period of asphyxia in it cannot cause accumulation of a sufficient amount of the hypothetical toxin to produce fatal constitutional effects.

Although no such accurate limits of time or mass of tissue have been established clinically, it is beyond question that a number of hours of circulatory occlusion in the human thigh will be fatal, and that similar stoppage in both thighs will be much more rapidly fatal. One case from the World War experience, mentioned by Cannon, is noteworthy as proof that death can result from the ligation of one arm. Here the time of application of the tourniquet was unknown, but it must have been very long in order to produce such an intensive effect. It is very doubtful, by comparison with ligations of the forelegs of animals, if asphyxia of such a comparatively small mass of tissue as the human arm for eight or ten hours would entail any serious constitutional danger.

The division between extensive and intensive tissue injuries is not merely didactic but seems to have real significance. On the theoretical side, it may be noted that the local accumulation of fluid, which is the cause of death according to the purely physical hypothesis, increases with the length of survival, because time is one factor. Thus, comparison of five-hour ligations with ten or twelve-hour ligations gives the paradoxical result that the most intensive and rapidly fatal shock is accompanied with the least local exudation. This is one of the objections to the physical hypothesis as a sole explanation. On the practical side, there are some indications that the response to therapy differs when similar degrees of shock are produced respectively by extensive or by intensive injuries. For details, reference must be made to the paper cited.

TREATMENT OF SECONDARY SHOCK

Amputation. When the limb is amputated without releasing the tourniquet, practically all symptoms of shock are prevented. In any given species, standard time limits can be established; for example,

in the rat, following a five-hour ligation of one hind leg, if the leg be amputated in one or possibly two hours after release of the tourniquet, life can still be saved. If too long a time is allowed to pass, amputation is unavailing. These experiments agree with the practice of surgeons, who have long been aware of the benefit or necessity of removal of the injured part for relief of shock. This means, according to the physical hypothesis, removal of the area of fluid transudation, and according to the toxic hypothesis, removal of the site of poison production.

The only other therapy of specific value must be credited to the physical hypothesis, namely the attempt to replenish the depleted circulation. It is convenient to consider this treatment in late and early stages of shock.

1. It is recognized that all treatment in the extreme terminal stage of shock is hopeless. This holds true regardless of the nature or degree of the original injury, and even in cases which might readily have been saved by early treatment, because the continuance of shock and hypotension for a sufficiently long time is in itself productive of an irreversible and fatal condition.

Experiments on rats in the late stages after ligations of limbs showed a very marked reviving effect of transfusions. The results are just as good with blood from animals which have died from shock as with normal blood. Therefore, under the toxic theory it must be admitted that the quantity of circulating toxin at any one time is not great enough to cause appreciable harm. Under the physical theory it must be recognized that the shock blood is beneficial in spite of its high concentration, while on the contrary no such benefit is obtainable with plasma alone, from either shocked or normal animals, or with saline or gum arabic solution. The benefits at this stage are only temporary, perhaps prolonging survival by several hours. It is conceivable that the addition of both plasma and corpuscles may be an aid to respiration and tissue nutrition in the state of hypotension and vasodilatation. This evidence agrees with the current surgical view that transfused blood has some advantage over saline solution under some conditions of shock. It seems possible that the increased volume of circulating plasma and corpuscles may be of some help also when there is an element of primary shock with its vasodilatation, which may coexist with the secondary shock.

2. The treatment is most successful and also most instructive when it is started early, preferably at the very onset of shock. The following facts are demonstrable:

(*a*) Transfusions definitely save life in degrees of shock which would otherwise be fatal. Plasma seems somewhat superior to whole blood, while corpuscles alone have little value. These results are in accord with the physical hypothesis.

(*b*) With more severe shock, injections of blood or plasma fail to save life, even though reduction of volume and increase of concentration of the blood are prevented from beginning to end. These results appear contrary to the physical hypothesis.

(*c*) Animals of this class, which cannot be saved by transfusion, can be permanently saved by sufficiently early and abundant injections of saline solution. This evidence removes the objection to the physical hypothesis mentioned under (*b*), but it overthrows fundamental prevailing views of theory and treatment, namely the idea that increased vascular permeability creates a necessity of giving a fluid containing protein or gum to make it stay in the vessels. Emphasis is placed not on increased permeability of the vessels, but on increased demand of the tissues for fluid, and when this demand is satisfied, the plasma remains in the vessels. The condition is therefore radically different from hemorrhage, which requires blood, plasma or gum solution for maintaining the circulation. Secondary shock, for its early and effective treatment, resembles dehydration in requiring a fluid which will pass out of the vessels as easily as possible. In either case the addition of anything which

hinders such fluid migration is harmful instead of helpful.

(*d*) With the tourniquet it is possible to produce still more severe forms of shock, which are fatal in spite of the maintenance of the blood volume and composition by transfusions, salt solution or combinations of the two. This fact is definitely antagonistic to the physical hypothesis as the sole explanation of shock.

Therefore, if the effects of ligation be accepted as true, typical and uncomplicated secondary shock, the studies which are made possible by this method, and which can be carried much further by persons enjoying better facilities, promise to be of considerable theoretical and practical importance for this subject.

SUMMARY

This paper, which is a resumé of experimental findings over several years, may be summed up incompletely as follows. The effects of tourniquet constriction are (1) local and (2) constitutional.

1. The local effects are due to:

(*a*) Direct pressure damage in the zone of ligation, influenced largely by the character of the tissue and the material, form and tightness of the ligature. Contrary to the prevailing view, the evidence indicates that narrow rubber bands or tubes are less harmful and painful than broad tourniquets. This direct pressure injury is probably more responsible for such after-effects as contractures and permanent paralyses than the temporary tissue asphyxia, and it is partly avoidable.

(*b*) Local asphyxia, which can be endured for much longer periods than commonly supposed, up to fifteen hours in experimental animals, and probably for this time or even longer in man. The different viscera can withstand various shorter periods of lack of blood. These survival periods are shortened by vascular disease, infection, and especially by heat.

2. The constitutional effects represent a form of secondary shock which is of clinical and experimental importance. While the physical theory of fluid migration is well supported by facts, it appears inadequate as an etiologic explanation without the assumption of a toxic factor. The experiments modify the prevalent idea of vascular permeability in shock by suggesting also a special avidity of the tissues for fluid. Likewise the special benefit of transfusion exists only within narrow limits. In general the greatest aid in shock is the injection of very abundant saline solutions beginning at the earliest possible stage.

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PATHOLOGY AND THERAPY OF THE "SHOULDER JOINT COMPLEX"

ERNST BETTMANN, M.D.

NEW YORK CITY

THE diagnosis and treatment of diseases of the shoulder are especially difficult, due mainly to the complexity of function of this organ, which has developed from that of a simple walking and supporting mechanism in the quadriped to a highly differentiated, grasping organ with the greatest possible range of action in man. Usually injuries do not only involve the joint itself, but also the surrounding muscles and capsule, causing a functional disturbance of the corresponding joints.

Improper diagnosis and treatment of shoulder injuries can be avoided by an acquisition of a thorough knowledge of the physiology of the shoulder and the application of treatment strictly in accordance with each mechano-pathologic change. Although it is almost impossible to know the difficult and incompletely understood mechano-pathology of the shoulder, we can discuss a few basic principles and methods of treatment employed in 300 cases of shoulder disease treated in the Orthopedic University Hospital in Leipzig, Germany.

We use the term shoulder joint complex to indicate the anatomic and functional unity represented by the humero-scapular joint, the acromioclavicular, sternoclavicular and thoraco-scapular space, with the connected muscle and capsule apparatus. Since injury to one joint or its attachments invariably causes disturbances in the others, it seems advisable to speak of the "complex" rather than of its individual components.

The subject will be discussed under the following subheadings:

I. Mechanics of the shoulder complex.
   - A. Crane construction.
   - B. Law of compensation.
   - C. Function.
   - D. Joint capsule.
   - E. Mucous bags.
   - F. Muscles.

II. Pathology of the shoulder complex.
   - A. Traumatic damage: different contracture forms, joint block, joint stiffness, static injuries.
   - B. Bursitis subdeltoidea and subacromialis.
   - C. So-called periarthritis humeroscapularis (Duplay).
   - D. Shoulder rheumatism.
   - E. Infectious arthritis (osteomyelitis, tuberculosis).
   - F. General and special forms of arthrosis deformans.

III. Diagnosis.

IV. Treatment.

V. Prognosis.

I. MECHANICS

The construction of the shoulder joint may be roughly compared with that of a crane, which, mechanically speaking, is a machine for the purpose of lifting, lowering and displacing weights. Its range of action may be increased by means of extension arms. In the shoulder we have two such arms, the shoulder blade with its spina scapulae which covers the main joint, and the clavicle which is connected with it. The range of action of the main shoulder joint is considerably increased through the two arms. These are not fixed, but, like a movable revolving crane, can be operated in a perpendicular axis (moving the arm back and forth), and like an ordinary crane, in a horizontal axis (raising and lowering the arm). The fact that the two arms are connected by two genuine joints, the sternoclavicular (Fig. 1*a*) and the acromioclavicular (Fig. 1*b*), and by two muscle joints, the scapulo-thoracal (Fig. 1*c*), and the subdeltoid gliding space,

makes it possible for the shoulder joint hollow to be moved in new planes and doubles the sphere of movement. In this manner the shoulder joint hollow can be raised 14 cm. when the shoulder blade arm is raised, and this may be combined with a revolution of 60 degrees. It is only due to this great lifting power, in which the clavicular arm in the sternoclavicular and acromioclavicular joint participates, that the vertical raising of the arm is possible.

In most movements of the shoulders, the shoulder blade arm is the most important for changes of position and revolutions, with the thorax curvature as a gliding surface. The clavicular arm participates to a limited extent in these movements. Figure 2 illustrates how great a rôle is played by the shoulder blade in most shoulder movements, since it is not fixed, but moves concomitantly, increasing motion from 20 to 60 degrees in single planes.

It is possible to judge properly the mobility of the shoulder joint (articulatio humeroscapularis) only when the shoulder blade is fixed. This is due to the fact that the arm can be raised 50 degrees farther when there is a forward motion of the shoulder blade in connection with the joint proper. In reality, all movements begin in the main shoulder joint, and are either completed or replaced by action of the two arms in the thoraco-scapular and sternoclavicular joints.

Any portion of the shoulder joint complex can, to a great extent, substitute in function for any other. The more axes a joint possesses, the greater are the possibilities in compensating for the deficiency of other joints. This law of compensation is better illustrated in the shoulder joint than in extremely complicated technical constructions. For example, the arm, raised sideward, is to be brought forward at an angle of 30 degrees; this takes place equally either in the sternoclavicular joint (Fig. 1*a*) or, in the case of fixation of the latter, in the acromioclavicular (Fig. 1*b*), or in the humeroscapular joint. The original position of the arm and the particular circumstances determine which of the three possibilities is to be used. A further compensation can be achieved by turning the torso or moving the hip.

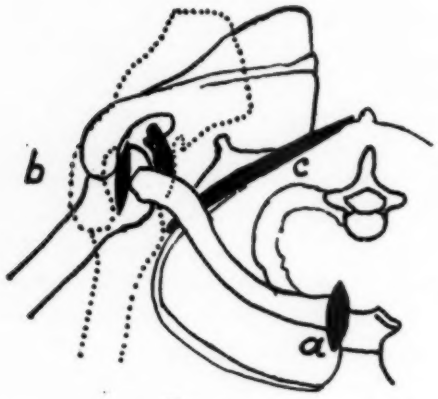

Fig. 1.

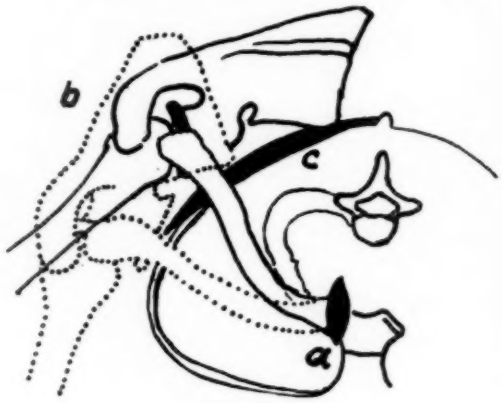

Fig. 2.

Figs. 1 and 2. The shoulder complex from above (after Braus). *a* and *b*, the sternoclavicular and acromioclavicular joint. *c*, the thoracoscapular joint (muscle joint).

An especially impressive example of the power of compensation is shown in Figure 3. In this case (seen five years ago), the shoulder joint (the humeroscapular joint) had been artificially stiffened in the treatment of a poliomyelitic deltoid upper arm paralysis. This operation made it possible for the patient to raise his arm sideward and forward up to shoulder level with the help of the compensatory joints and musculature. The man, unemployed because of his deformity before operation, is now able to work in a textile factory.

An examination of the muscles of the shoulder complex shows even more clearly its intricate construction. No other joint

A B

Fig. 3. Compensation of the paralyzed deltoid and upper arm muscles by the shoulder blade (arthrodesis of the humeroscapular joint).

possesses such a variety of muscular shifts as the shoulder, and these muscles also compensate and substitute for one another. For example:

1. Raising the arm forward requires the action of the pars clavicularis of the deltoideus, the pectoralis major, both the biceps, the serratus anterior, and the middle and lower trapezius.

2. Raising the arm to the side requires the pars acromialis of the deltoideus, the supra-infraspinatus, the biceps caput longum, the lower serratus, and the middle and lower portion of the trapezius.

3. Raising the arm backward requires the backward portion of the deltoideus, the teres major, the latissimus dorsi, and the levator scapulae.

A B

Fig. 4. A, the anterior capsule pocket filled with jodipin. The borders grow together after longer abduction of the arm. B, the necessary abduction position of the arm up to the horizontal. This prevents shrinkage of the capsule.

4. Vertical elevation of the arm requires turning of the scapula by the supraspinale, acromiale and clavicular portion of the

trapezius, the pectoralis major, the levator scapulae and the rhomboideus.

5. Inward rotation of the arm is accomplished by the subscapularis.

6. Outward rotation is accomplished through the teres minor, infraspinatus, the pars spinatus, pectoralis major, the latissimus dorsi and the levator scapulae.

The construction of the enormous muscle coat converging in the form of a funnel guarantees the greatest possible radius of action. The joint, with the head of the humerus, articulates with only two-thirds of its surface. Slight, and apparently superficial, injuries to the muscle coat can cause an insufficiency of the whole joint complex, as is evident when one considers that in the humeroscapular joint the importance of the muscle is greater than that of the bone.

The bursae and the joint capsules are also determining factors in shoulder function, since the muscles are to a certain extent directly inserted, and in other cases regulate the tension so that the capsule does not fold inward. A disturbance of the muscle equilibrium causes the capsule to lose its optimal tension and it soon begins to form folds which tend to adhere. The lower front portion of the capsule insertion, the recessus axillaris, is especially disposed to do so when the arm hangs down for a great length of time. (Fig. 4.) In addition, there are two side chambers (vagina mucosa intertubercularis and bursa subscapularis) and three bursae (bursa subdeltoidea important because of the muscle joints, bursa subacromialis and bursa subcoracoidea).

II. PATHOLOGY OF THE SHOULDER JOINT COMPLEX

A. Traumatic Damage. The most frequently encountered disorders of the shoulder are injuries, mainly distortions and contusions. Fractures and luxations will not be discussed here. Distortions and contusions usually involve a more or less severe tearing or squeezing of muscle fibers and parts of the capsule. There is an intimate connection between the capsule and the surrounding muscles because these determine the optimal capsule tension for each position of the joint. It is therefore natural that a disturbance of the muscle function will cause a disturbance of this especially sensitive capsule. The injury, whether it is contusion or a contortion, results in a state of insufficiency in the shoulder complex (Ehalt[11]) and incomplete elevation of the arm. This brings with it the possibility of a contracture of the adductor muscles. In addition, the traumatic irritation of the sensory sympathetic nerve endings in the muscle fibers or in the highly innervated capsule apparatus causes first a hypotony of the muscles (Leriche[24]), and then a hypertony or *Hartspann*. This then brings about dynamic spastic contracture with resulting capsule shrinkage.

Mere mechanically compulsory contracture does not suffice for the production of serious effects in the muscular or capsular tonus organs. The restriction of movement, caused by the soft parts, is called "joint block" (Payr[29]). If it is impossible to relieve the mechanical and dynamic joint block, the result is a joint stiffness with serious periarticular and intra-articular damage. The destruction of the cartilage and synovia, together with a loss of the joint space, means the functional death of the joint. Because of insufficient resorption of the hematomas and irritation of a traumatic synovitis, the bursa, tendon and capsule complex shrinks. The joint capsule is thereby pressed on the joint body and the overstretched deltoideus and supraspinatus muscles become atrophic. The gliding ability of the muscles which have become fibrous (pectoralis, subscapularis, teres) either completely disappears or is seriously damaged (the so-called inactivity damage of the joint).

In summary, this procedure is: injury; muscular hypotony; restricted motion; mechanical inactivity; contracture; increased contracture through muscular or articular irritation; hypertony or *Hartspann;* reflex, dynamic or spastic contracture. The clinical sequence is: joint block;

continuation of irritation; increase of inactivity; injury by pericapsular and intracapsular contraction and destructive processes; joint stiffness. Therapeutic measures must therefore be directed to arresting the destructive process in its earliest development.

A B

Fig. 5. A, bursitis subdeltoidea and subacromialis. B, caries sicca. No defect of the bone. Cartilage peeled off. Border of compacta appears like a pencil line. Cystic spots. Head drawn up by contracture.

In 100 accident cases involving the shoulder, there were fifty-seven purely muscle capsule injuries and forty-three cases of fractures and dislocations. In these cases the following pensions were paid after one year:

Pension	Muscle Injuries	Dislocations and Fractures
60 per cent	1	3
30–40 per cent	16	10
20 per cent	16	14
10–15 per cent	24	11
None	8	4

The high rates in the cases of apparently slight contusions are due to the resulting serious joint stiffening, arthritic changes, neuritic or paretic symptoms. From the point of view of accident statistics, it is interesting to note that only two patients were under 40 years of age. In other words, the majority of the patients were at an age at which the muscle joint apparatus had already lost its optimal ability for work and reaction.

B. Bursitis Subdeltoidea and Subacromialis. (Fig. 5A.) Steindler states in his significant works[15,36] that: "The (shoulder) bursa is subject to the same inflammatory changes as is any other bursa in the body. Chronic inflammations of the bursa are of greatest orthopedic interest, as they may lead to severe chronic disabilities of the shoulder and the formation of adhesive strands which finally may obliterate the bursa entirely."

This bursitis, which often comes very suddenly and is not readily recognized, may assume the appearance of a serious and painful shoulder joint block, but it disappears as rapidly as it comes. Formerly it was often incorrectly called "periarthritis humeroscapularis," but the only connection with the capsule and joint complex is the fact that the resulting pain leads to the joint block.

Erb and Friedriszik[12] have described four cases of bursitis calcarea acuta which were characterized by sudden and very painful shoulder block with typical pressure points directly under the acromion and near the tuberculum majus. We have observed five such cases, three of which involved elderly women past the menopause with no previous traumatic history.

In these cases the typical cap-formed, smooth-edged shadow under the deltoideus

or the acromion disappeared after a few months. These cases showed a calcium gout located near the shoulder (Schmidt) as a sign of a chronic metabolic disturbance, in combination with the acute inflammatory symptoms. Bursitis here is not the cause but the result of the ailment, and the calcium phosphate (Tavernier[37]) acts as a foreign body. At times, a constant deposit of calcium can result from a damaged spinatus or subscapularis tendon (calcinosis interstitialis) where dead connective tissue is concerned. When due to the bursitis subacromialis, the arm is abducted, the pressure point under the acromion often disappears (Dawburn's sign). In addition, the rheumatic, traumatic and metastatic infectious component (for instance, after panaritium), plays a certain part.

Jarjavay described, in 1867, a bursitis subacromialis traumatica. Polichetti removed a calcified bursa which had developed after traumatic lymphangitis. M. H. Rogers,[30] analyzing 100 cases of subdeltoid bursitis, has ascertained that it is not a condition of youth, but of middle and old age, and that there is no evidence of an element of focal infection as is so commonly thought.

In order to prevent the long drawn out treatment that is sometimes necessary in these cases, one should have a clear picture in mind as to what is going on and what the results should be.

C. So-called Periarthritis Humeroscapularis. The term periarthritis humeroscapularis, insofar as an arthritis can never be "peri," is misleading. It is always connected with the bone in the interior of a joint and is chiefly situated in the glide and capsule apparatus. All the unknown diseases of the shoulder connected with stiffness are attributed to it, according to Duplay (1867), although obviously injuries and infections should be excluded. A large number of cases remains etiologically unexplained, because insignificant shoulder trauma or rheumatism affords an insufficient explanation for the serious changes. The hypothesis of A. Muller[26] that periarthritis humeroscapularis and rheumatism are only different manifestations of one and the same disease, because the muscles are the roots of the disorder is not a sufficient explanation for the serious changes. It is characterized by slow, progressive and painless development, and is influenced by a natural predisposition.

One day the patient notices suddenly that he cannot brush his hair or button his trousers. The connective para-articular tissue is glued to the fibrous capsule, which has become a hard scar wall, a shrinking process particularly affecting the mucous bag, especially the muscular space under the deltoides muscle. The joint shows no inflammation and, besides the plastically thickened capsule shadow, the *x*-ray shows no change of the joint structure. At last, as a consequence of the fixed position of the shoulder, we can see loss of calcium and obliteration of the joint space.

Men and women about 40 years of age are usually affected. The etiology is almost as little understood as in the analogous diseases of Dupuytren contracture and fibrosis intervertebralis. There exists the possibility of an inflammation (possibly a mild tuberculosis) around the capsule nerve. In place of the general term, which is clinically and grammatically incorrect, it would be better to substitute the name contractive shoulder stiffness (capsulitis fibrosa-adhesiva humeroscapularis). Similar ailments of other origins must be excluded.

D. Shoulder Rheumatism. Many disorders are treated as rheumatism, for apparently what we cannot define or explain, we consider rheumatism. As for genuine polyarthritis rheumatica in primary or secondary, chronic, adhesive or ulcerative form, there is no difficulty in diagnosis. Other joints besides the shoulder are frequently affected. The predisposition to joint stiffness, caused by trauma of the cartilage and the subchondral bone marrow space, appears early. The rheumatoides, caused by transitory symptoms of omarthritis, are not so important.

The interesting papers of Brown and Kuhns[9] and Schede[33] have contributed some explanation regarding the question of painful shoulders. It follows that in many patients with poor posture, caused by the habitual dropping of the shoulder girdle, the balance of the muscular system is disturbed. It is therefore overloaded; a chronic rheumatism and a static arthritis of the shoulder joint is the result.

M. Lange[23] found "Myogelosen" in the trapezius, pectoralis, deltoides, latissimus and infraspinatus, as the cause of shoulder pains, which could be absolutely cured by massage. In 300 cases, I have never encountered such so-called rheumatism of the acromioclavicular joint (Millner) as a special disease entity. There were, however, cases which were classified as muscle and capsule rheumatism of the shoulder joint because they began with acute and sharp pains around the large joint, preceded by occasional attacks in bad weather. This is not the same as the adhesive shoulder stiffness outlined above. Dollinger[13] described a typical form in which there were pains in the fossa supraspinata between the middle and median third, with the characteristics of a root neuralgia which he attributed to traumatic exhaustion of the muscularis supraspinatus.

E. Infectious Artbritis, Osteomyelitis, Tuberculosis. Among the typical malignant types with the most serious, irreparable, gradual shoulder impairment, is the infectious arthritis caused by slow sepsis with joint metastasis as a result of a primary disease (angina, gonorrhea, granuloma). Unlike the other shoulder joint disorders, this type develops only in the joint, with a progressive and rapid destruction of cartilage, bone and synovia. Because the process is primarly intra-articular and the synovial membrane less painful than the fibrous capsule which is filled with many sensitive centers, the muscle stiffness is not so important. In these cases an exact distinction between the intracapsular and extracapsular form is not always apparent.

Of the acute inflammations, osteomyelitis, with all the appearance of an acute or chronic sepsis, must be mentioned; it ends in serious bone destruction with complete joint stiffness and obliteration of the capsule. In the beginning, primary chronic osteomyelitis can be easily mistaken for rheumatism or tuberculosis. Chronic tuberculosis of the shoulder joint (constituting twelve of our 300 cases) is connected with subchondral destruction, and ends rapidly in stiffness, depending on the extent of infection. Another form, found especially in older people, is the often painless caries sicca, with typical synovial spreading and obliteration of the capsule. (Fig. 5B.)

F. Arthrosis Deformans. Of the chronic degenerative shoulder diseases, we must mention arthrosis deformans, which is seldom primary, frequently occurs in both shoulders, and is constitutional or endocrine in origin. More frequently it is secondary, following damage caused by disuse in consequence of an inflammation or traumatic irritation. This was observed in 12 per cent of our cases. A special primary form of arthrosis deformans is arthrosis deformans acromioclavicularis, which can lead to the tearing of the biceps muscle tendon. The luetic or metaluetic diseases have the same form as in other joints.

In our own clinical material, there were a case of tumor (sarcoma) and one of Paget's disease, both of which began with gradual stiffness accompanied by pain.

III. DIAGNOSIS

It is absolutely necessary to diagnose and treat the joint disease as soon as possible, since the mobility of the joint depends upon it. Therefore even the slightest diagnostic symptoms must be observed. This is particularly important when the patient, because of the slow, progressive nature of the disease, hardly notices that he is the victim of a shoulder disorder. Neuralgia, spreading to the fingers, a feeling of greater weakness of the arm, the impossibility of lying on one side during the night—these

may be the first symptoms of a shoulder stiffness.

The examination of both shoulder joints

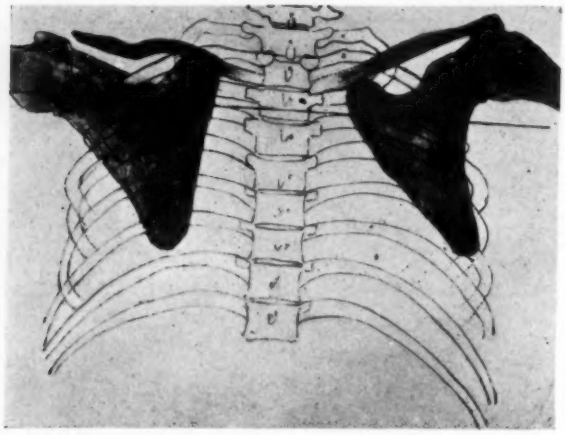

Fig. 6. *X*-ray showing stiffness of left humeroscapular joint, shoulder ridge symptom. Compensation in sternoclavicular and acromioclavicular joint, gliding to the side and turning of scapula.

at this point already shows significant limitation of active and passive motion. The patient has difficulty in putting the hand behind the sacrum, behind the shoulder blade or on the neck, shoulder ridge or head. The history may include former trauma, rheumatism or past infections (angina, panaritium, gonorrhea, or syphilis). If the patient shows painful block in a muscle area after a certain movement, there is a definite clue to the location of the torn muscle or tendon. Such shooting pains may frequently occur in raising the arm, shortly before the horizontal plane is reached; in an endeavor to reach a horizontal position by force, the arm falls down as if paralyzed.

Friction noise, heard or felt, is no proof of real damage in the shoulder, although of great concern to the patient. More significant is the evidence of hindrance in the use of the arm perceptible on inspection. This may be due to contraction of the pectoralis, subscapularis, latissimus, infrasupraspinatus, or teres major. If the impediment remains, the humeroscapular joint is increasingly eliminated and the compensating joints increase their function. There follows contraction of the trapezius (pars descendens) and the levator scapulae, and atrophy of the overstretched deltoideus muscle. As a result, an absolute displacement of the normal shoulder picture takes place and we have a typical triad: shortening of the shoulder ridge line, steep incline of the clavicle and generally high position of the shoulder blade.[2] (Fig. 6.) This symptom, noticeable through simple observation, is important in recognizing malingering, especially after accident and injury. The greater the hindrance in the humeroscapular joint, the earlier and farther away the turning scapula wanders forward on the thorax wall, as the shoulder blade goes with it. The "out-rigger" of the crane is thus much more elevated in the sternoclavicular joint to compensate for the loss of movement.

In palpation we notice that at the points of insertion of the contracted muscles, which are often hard as boards, pressure is painful. If the rotators are affected, the subscapularis, felt at the axilla, is also painful, like the supraspinatus and infraspinatus on the shoulder ridge, where they are inserted in the capsule joint. There are also painful pressure points at the insertions of the anterior and posterior part of the deltoides muscle. If a bursitis exists, such painful points of pressure are typical below and near the acromion and at the outside of the deltoideus muscle, corresponding to the tuberculum majus. If pain radiates from the acromioclavicular space, a diagnosis of arthritis is possible. Sudden hypotony after trauma (Albert) we cannot prove, but on the contrary, Hartspann is to be regarded as the first symptom of muscle hindrance.

The functionally damaged shoulder shows an early abduction hindrance with insufficient reversion, as well as impaired outward rotation. The passive as well as the inward movements are generally impeded later on. The best test is to have the patient sit on a chair for the examination of both shoulders. The affected shoulder is found to be fixed from above.

Sensory and motor disturbances appear in the various forms of paresthesia and

neuralgia, especially on the outer aspect of the upper arm, although we must also consider the cervical ribs in the presence of such symptoms. The deltoideus and supraspinatus muscle is atrophied in the early stages, in contrast to the hypertrophied trapezius. By an intra-articular process, other spontaneous pains and a stretching pain in passive movement arise.

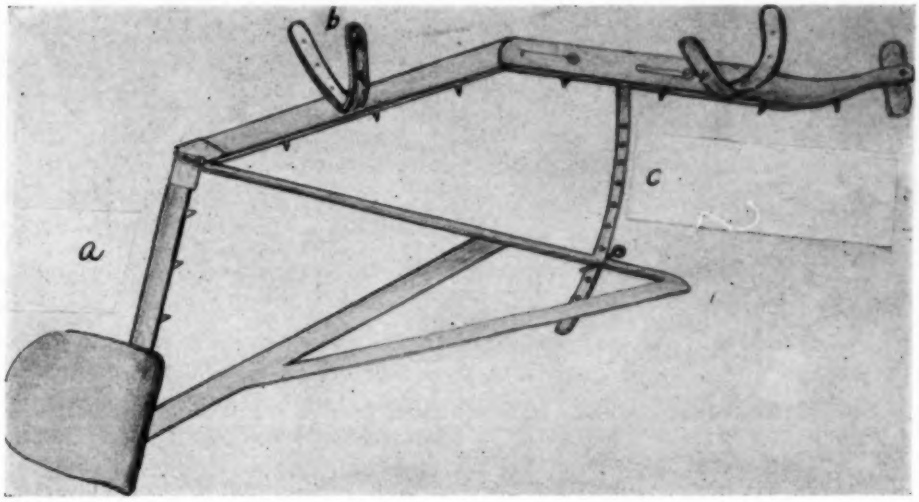

Fig. 7. Barbed splint designed by the author for restoration of mobility to the shoulder and fixation of the arm in abduction. *a*, chest part. *b*, upper arm section. *c*, changeable elevation on the arch.

The *x*-ray, which is only a link in the long chain of proofs, gives no evidence of the muscle and capsule process. We are astonished to find, in spite of the most serious joint stiffness, that there is only an elevation of the head with possible narrowing of the joint space and perhaps a capsule shadow. In doubtful cases, *x*-ray of both shoulders is necessary; if it is possible for the patient to raise his arm to the horizontal position, an axial picture is to be preferred, since there is a better view of the acromion, caput humeri, joint space and processus coracoideus. In damage caused by rest with complete stiffness, the capsule shadow gets paler and the bone structure loses in density and regularity (mottled atrophy, halisteresis). The ridges in arthritis acromioclavicularis (Fig. 4A) and the edges of para-articular calcium gout are easily recognized. In caries sicca it is noticeable that before the bone itself is damaged, the cartilage is already lost, appearing peeled off, and the glass-like bone structure is typical. This may also be seen in infectious arthritis and in the monoarticular form of rheumatism. In all cases of undiagnosed shoulder injury, blood tests are necessary to establish the sedimentation time and differential. Other diagnostic measures are tuberculin testing, Wassermann or Kahn tests, and a search for foci of infection in the nose, pharynx, genitourinary tract and teeth, as well as for possible endocrine disturbances.

IV. TREATMENT

Inasmuch as the shoulder joint, once injured, easily becomes stiff, early treatment is essential to avoid irreparable damage. The use of liniments and fixation of the arm in a sling after a simple shoulder sprain or rheumatism have often led to permanent stiffness.

The most important therapeutic treatment is the prevention of contracture, which may result from even a simple shoulder injury. The best method, even though the patient may not like it, is to put the arm immediately in an abduction splint.[4,16,17,27,28] The danger of contraction of the lower capsule (recessus axillaris) is thus prevented; the deltoideus is not over-

stretched, while the adductors are not contracted. In this way the patient suffers no pain. The splint is kept on until it is

Fig. 8. Massage of the shoulder joint (kneading the subscapular contraction).

possible for him to raise his arm above the horizontal line. Of the many types of splints, I prefer the barbed splint (Fig. 7), which is light, may be used on both sides, can be fixed by elastoplast by means of the barbs and can be changed in elevation. For this reason it may be used as an exercise treatment splint in cases of neglected shoulder stiffness.

Besides the splint treatment, exercise is necessary, first simple movements and later more complicated ones. During rest periods, moist warm poultices of antiphlogistine, camilla or priessnitz are applied. Since exercises in which the shoulder blade is active are of no use, in cases of fixation of the humeroscapular joint, we fix the shoulder blade by means of a special belt. The patient steps into this and it is arranged and strapped so that no movements are possible except those in the humeroscapular joint.

Another good method in cases of muscular contraction or joint stiffness, as well as in contusions[24] is the injection of procaine (1 or 2 per cent). In obstinate cases, six injections are usually required. Infiltration is especially necessary in the spaces between the deltoideus, pectoralis and subscapularis muscles. The acquired improvement in the motility of the shoulder is then fixed in a splint. By means of the procaine the tension of the muscle is diminished and the sensitive nerves are temporarily paralyzed. This elimination of irritation is of great therapeutic value, because the reversible muscle tonus (Hartspann) stops, and the irritation of the peripheral tonus organs ceases, especially if the interior of the joint is anesthetized.

In cases of infectious arthritis, it is useful to employ phenol camphor solution for injection in the following combination:

Acid, carbolic cristal	30.0
Camphor. titrae	60.0
Alcohol abs.	20.0

A dose of 0.7 to 1 c.c. is injected into the joint. The phenol and camphor cause an antisepsis in the hollow of the joint and an artificial effusion distending the capsule.

In tuberculosis of the shoulder joint, good results have been achieved by the use of Calot's solution, a useful preparation too little known:

Oleum oliv.	70.0 (not to be used in abscess)
Ether	30.0
Creosote	5.0
Guiacol	1.0
Iodoform	10.0

In order to regenerate and loosen the muscles, a careful rubbing and kneading massage is very important. By this means the contracted pectoralis and subscapularis are thoroughly relaxed and are distended by the patient's placing his arm on the shoulder of the masseur. (Fig. 8.) It is advisable for the physician to perform this massage himself. Faradisation (interrupted swelling current) and vibration of the overstretched deltoideus muscle are also recommended. According to Brown and Kuhns,[9] correction of the dropped position of the body, as well as the position in which the shoulder is habitually used, should be an essential part of the treatment in disabling conditions of the shoulder.

Greenberg[15A] recommends the following procedure for acute bursitis with procaine lavage: The areas of greatest tenderness are carefully mapped out by gentle pressure with applicators. An ordinary hypodermic needle of intramuscular caliber and

with a short bevel is introduced into the sites of greatest bursal sensitivity. Several cubic centimeters of a 2 per cent procaine solution are slowly injected and then aspirated. The material withdrawn may be either chalky or brownish in appearance. This procedure is slowly repeated until the patient is completely relieved of pain. Active motion of the shoulder in all directions is encouraged. This is followed by a full range of passive manipulation. In this manner, the bursa is further emptied of material and adhesions are broken up. In certain cases, when the effects of the procaine disappear, pain, of varying intensity, recurs. This generally subsides in twelve to sixteen hours, but may require an opiate. No form of immobilization is used. Slings are avoided. Diathermy and short wave are of no value at this time. Resumption of the daily routine of work is permitted within three or four days from the time of lavage. It is important to note that this treatment is less effective in cases of chronic bursitis, where other measures, more prolonged or radical in character, may be required.

The forced redression with fixation in plaster of paris, in which a noticeable cracking of the fibrous adhesions occurs, is not to be advised.[35,36] Only in cases of traumatic muscle stiffness and with persons under thirty years of age may it be used if done very carefully, as in cases of fixed flat foot. Redressing employed without system produces only fresh trauma.

Klapp[21] recommends, in cases of old capsule contraction with levated head, the operative splitting of the capsule with excision of a large part of the capsule tissue. We warn of such a radical treatment, especially in cases of accident, because careful conservative after care is always necessary.

In such obstinate cases of stiffness and contraction, good results are achieved by gradually loosening the muscle with our special apparatus. (Fig. 9.) On a portable corset of plaster of Paris, which is strapped over the patient and which allows movements only in the shoulder joint, a traction apparatus is fixed. By this screw jack, the patient himself can gradually raise his arm

Fig. 9. Removable redression corset of plaster with correction apparatus, adjustable by the patient himself, for careful painless treatment of shoulder stiffness.

and move the stiffened joint. From the pulley screw, a cord goes over an extended adjustable arm, at the end of which is a wheel. Over this the pulley line goes to a leather cuff to which the wrist of the patient is fastened. By changing the crane, it is possible to correct the sideward and backward movement of the arm. The apparatus can also be completed by an apparatus for extending the shoulder joint, which is important for enlargement of the joint space and for the elevation of the head in its normal position.

We have also employed to great advantage the cataphoretic application of histamine (imadyl, Roche) or massage with imadyl ointment to effect a hyperemic and analgesic result. Short wave diathermy and *x*-ray treatment are especially recommended for bursitis subdeltoidea. In the infected and rheumatic forms of shoulder

disease, treatment with internal medication is also vital. Sinnodin is used for this purpose because of its rapidly alleviating effect (3–6 c.c. are given intravenously with atophanyl 10 c.c. intravenously daily). Solganal B also gives good results when combined with large doses of aminopyrine (3 gr. daily). In the metabolic diathesis we use urecidin, piperazin-midy and potash jodatum. In cases of arthritis deformans, we inject the artificial joint ointment, immetal, but in gonorrhea, arthigon is to be preferred.

SUMMARY

A synopsis of the mechanics, pathology and therapy of the shoulder joint complex is given. Some new methods of treatment are indicated, including the barbed splint, the redression corset and physiotherapy.

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SYPHILIS COMPLICATING PREGNANCY*

WILLIAM T. DAILY, M.D.

Department of Obstetrics and Gynecology, Long Island College Hospital

BROOKLYN, NEW YORK

FROM April 2, 1934, to September 1, 1937, 3,567 obstetrical cases were admitted to the Obstetric Clinic of the Long Island College Hospital, and of these 168 had syphilis, giving an incidence of 4.7 per cent. Of those that have received treatment, 100 have terminated their pregnancies. This paper, accordingly, is based upon our observation of these 100 syphilitic pregnancies.

At the time of admission to our clinic, blood for the Wassermann and Kahn tests is taken. If it is found to be positive or questionable, the tests are repeated in order that laboratory error may be eliminated. In a primigravida syphilis seldom is recognized unless routine serologic examinations are made. Forty-four of the 100 patients herein studied had positive Wassermanns and fifty-six were negative; each of the latter had previously received some antiluetic treatment.

In women the primary lesion of syphilis is more elusive than in men, and unless it is seen on the vulva usually is unnoticed. Only five women were aware of a primary lesion. The secondary manifestations likewise are often unnoticed, as the skin eruptions are less pronounced and disappear rapidly. Five patients gave a history of a rash. On the other hand, as in one case, the presence of condylomata lata may cause the patient to consult her physician. Five patients had congenital syphilis, and each had received treatment. In one of these, the infection was not noted until failing vision, at the age of 17 years, brought the patient to a clinic, where syphilitic interstitial keratitis was diagnosed. Of the thirty-two husbands examined, sixteen either had a positive Wasserman or had previously received treatment, and an equal number had a negative serology with no history of treatment.

It is the history of previous pregnancies that is most significant. Thirty-three gestations aborted; eight terminated in premature and sixteen in full-term stillbirths; eleven infants died neonatally. Often, as shown in Table 1, each succeeding pregnancy tends to reach a longer period of gestation. The patient whose history is given in the table failed to carry any gestation to term until the sixth pregnancy and then three ended in stillbirths. She received treatment during the ninth pregnancy and a living child resulted. We treated the patient during the tenth pregnancy, and the *x*-ray was negative for luetic long bone changes in this child.

TABLE 1
A SYPHILITIC PREGNANCY HISTORY

Pregnancy		
1st	abortion	2 months
2nd	abortion	2½ months
3rd	abortion	3 months
4th	abortion	3½ months
5th	stillbirth	7½ months
6th	stillbirth	full-term
7th	stillbirth	full-term
8th	stillbirth	full-term
9th	alive	full-term
10th	alive	full-term

When a suspicious history or questionable Wassermann is noted, 0.3 Gm. of neosalvarsan in 10 c.c. of freshly distilled water is injected intravenously and blood is taken for the Wassermann test, one, four and eight days subsequently. If the Wassermann is strongly positive in any of these three tests, the patient receives the routine antiluetic treatment. In one case

* Read before the Brooklyn Gynecological Society, October 1, 1937.

this provocative test definitely revealed syphilis in the mother and, as a result, an examination showed syphilis in her two children and also in the husband, all of whom were unaware of their infection. The unborn child, in whose interest the test was made, in the interval was born, and the *x*-ray was positive for luetic long bones.

Due to this observation, a routine provocative test was done on the next fifty cases of questionable and weakly positive serology. Twelve of fifty patients revealed in one or more tests a strongly positive Wassermann. One patient gave a history of a five months abortion and aborted the second time following five injections; *x*-ray of the long bones was positive for lues.

There is no false positive Wassermann of pregnancy, but there may be a false negative. Cases of latent syphilis may be detected by this method which may reduce some of the unsatisfactorily explained premature and full term stillbirths and late abortions. Five years ago these twelve patients would not have received treatment in this clinic solely on their weakly positive serology.

TREATMENT

During pregnancy, treatment is given primarily in the interest of the fetus and, fortunately, the chance of obtaining a good result is excellent. The treatment of the mother's syphilis is secondary. Because it is uncommon to find the spirochete in fetal tissue before the fifth month, the aim of early treatment is preventative. If sufficient arsphenamine and heavy metal can be deposited in the fetal surface of the placenta, the spirochete may be prevented from passing through the barrier to the fetus. After the fifth month, the aim is to treat intra-uterine syphilis. Comparatively few injections have a most marked effect upon fetal lues, as the spirocheticidal property of arsenic seems to be much greater in fetal than in mature tissue. That arsenicals pass through the placenta is shown by the relatively large amount found in the meconium.

The earlier treatment is begun, the better will be the results for both baby and mother, and our aim should be to secure a negative Wassermann as soon as possible. Treatment should begin as soon as the diagnosis is made, in the hope that the desired effect will follow. One need have no fear that treatment will cause an abortion; the latter may be caused by the infection but not the medication. Pregnancy, therefore, is a strong indication for the vigorous use of the arsenicals in the fight against congenital syphilis.

Treatment begun late in pregnancy, while inadequate, often produces extraordinary results. Even though treatment is insufficient, stillbirths may be prevented and the infection made less severe and more easily controllable in the child.

Once treatment is begun, it should continue until the child is delivered. Rest periods and so-called courses are not advisable. We are concerned about too little, not too much, treatment. Pregnant women tolerate arsphenamine well.

The following routine is recommended: 0.3 Gm. of neosalvarsan (neodiarsenol) in 10 c.c. of freshly distilled water is injected into the basilic or cephalic vein. If well tolerated, the dose is increased to 0.6 Gm. and repeated weekly. In addition, 1 c.c. of 10 per cent bismuth salicylate in oil is given intramuscularly two days before the arsenical. The treatment with both bismuth and neosalvarsan accordingly is repeated at weekly intervals from the first injection until the child is delivered.

Prior to each neosalvarsan injection, the blood pressure is taken and the urine examined for albumin. If any evidence of toxemia is present, the arsenical is withheld until all toxic signs disappear. In case of doubt, the treatment is not given. If the responsibility for the treatment is placed in the hands of one member of the Obstetrical Department, early toxic states may be recognized and serious arsenical accidents prevented. To the 100 patients, who form the basis of this report, 1,117 injections were given without any seri-

ous complication. One patient developed an exfoliative arsenical dermatitis, which slowly disappeared after injections were discontinued.

TABLE II
END RESULTS OF TREATMENT IN 100 SYPHILITIC WOMEN

Injections of Arsphenamine	Total Cases	Stillbirth Abortion	Living Infants with Syphilis	Living Infants without Syphilis
25–30	3	1 hydrocephalus	1	1
20–25	4	1 craniotomy	2	1
15–20	12	0	4	8
10–15	23	0	7	16
5–10	32	1 abortion (five months)	14	17
1–5				
1–5	26	0	9	17
Total.....	100	3	37	60

Following discharge the mother is referred to the syphilis clinic for further treatment and follow-up.

The child's syphilis is studied as follows:

1. The placenta is sent to a pathologist for histologic study.

2. A cord Wassermann and maternal Wassermann are taken at delivery.

3. A blood Wassermann of the child is taken before discharge.

4. *X*-ray of long bones is taken.

5. Observation for congenital syphilis is continued for a number of years in the pediatrics clinic.

END RESULT

The beneficial effect of arsphenamine is shown in Table II. Only two infants were stillborn and both of these were obstetrical deaths. In one, a craniotomy was done, and in the other the child had hydrocephalus. One patient aborted at the fifth month, following five injections. Thirty-seven infants of the remaining ninety-seven showed some signs which were suggestive of syphilis. Of the thirty-seven bad results, twenty-three occurred in women who had received less than ten injections of arsphenamine.

SUMMARY

1. Relatively few women are aware of the primary or secondary manifestations of syphilis.

2. The history of previous pregnancies is most significant.

3. An early serologic examination is imperative.

4. A provocative injection of neosalvarsan may reveal latent syphilis.

5. Treatment during pregnancy is primarily for the baby.

6. Pregnancy is a strong indication for the vigorous treatment of syphilis with arsenicals.

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PELVIC TUBERCULOSIS*

A REVIEW OF THIRTY-SIX CASES

MORRIS GLASS, M.D., F.A.C.S. AND JOSEPH CRESCI, M.D.

BROOKLYN, NEW YORK

THIRTY-SIX patients with proved genital tuberculosis were admitted to the gynecologic service at the Long Island College Hospital from December 5, 1923 through June 30, 1937. All were white women. The youngest in the series was 21 years of age, and the oldest 50. The following table shows the ages by decades.

Ages	No. of Cases	Per Cent
21–30	17	47.2
31–40	15	41.6
41–50	4	11.2
Total.....	36	100

A positive family history of tuberculosis was noted in four, while in eleven others it was strongly suggestive. The past history of these patients was significant. In two, a diagnosis of tuberculous peritonitis had been made at operation six and fifteen years before their present admission. Two had pleurisy, while one had been suffering with Pott's disease for the past eight years. The previous histories in eight other patients were suspicious of tuberculosis.

FERTILITY

Thirty-three, or 91.4 per cent, had been married for four or more years. The remaining three came under observation within one year of their marriage. In twenty-six, or 72.2 per cent of the series, conception had never occurred. Six women were relatively sterile as shown by Table I. In the remaining four, the presence of pelvic tuberculosis apparently did not interfere with conception or with the course of pregnancy. Their obstetrical histories are indicated in Table II.

TABLE I

Years Married	Gravidity	Parity	F.T. Delivery	Abortion	Ectopic	Date of Last Pregnancy
4	1	0	0	0	1	On admission
7	1	0	0	0	1	Three years
4	1	0	0	1	0	Three years
4	1	0	0	1	0	Three and a half years
7½	5	0	0	5	0	Two months
12	1	1	1	0	0	Eleven years

TABLE II

Years Married	F.T. Deliveries	Spont. Abortion	Therap. Abortion	Date of Last Pregnancy
11	6	2	0	Not stated
12	1	0	2	Four years
13	3	0	0	Two years
30	5	0	0	Not stated

SYMPTOMATOLOGY

The symptoms of pelvic tuberculosis frequently simulate those occurring in pelvic inflammation caused by the gonococcus, staphylococcus, or streptococcus. Our material yielded certain facts worthy of mention. The majority of the patients

TABLE III

	Noted In	Per Cent
Pain.....	33	91.4
Menstrual disturbance.....	27	75
Leucorrhoea.....	8	22.2
Sterility.....	6	16.6
Apathy.....	5	14
Loss of weight.....	3	8.4
Abdominal mass.....	3	8.4
Urinary disturbance.....	2	5.6
Cough.....	1	2.8
Repeated abortions.....	1	2.8

* From the Gynecological Service of the Long Island College Hospital. Presented before the Brooklyn Gynecological Society, October 1, 1937.

stated that their difficulties started insidiously after marriage, pregnancy, or menstruation. They usually complained of pain in the lower abdomen or back which was described as being dull in character and aggravated at the period. Many sought aid and in spite of treatment no relief was obtained. Sterility was common. The symptoms and their frequency are tabulated in Table III.

Thirty-three, or 91.4 per cent of the patients, complained of pain which in twenty was localized to the lower abdomen. Five women experienced pain at their periods, while in three dyspareunia was a troublesome feature. Backache was prominent in three cases and two others had pain in the right lumbar region.

Menstrual alterations were frequent and occurred in twenty-seven, or 75 per cent, of the cases. Five patients complained of menorrhagia, while seven others noted a marked prolongation in the interval between succeeding periods. Six women experienced irregular vaginal bleeding and in four the flow was described as being very scant. One young woman of 22 had not menstruated in the past two years.

Only six patients complained of sterility. Still we noted that twenty-six women were absolutely and six relatively sterile. It would appear, therefore, that the majority of these women had given up all hope of ever conceiving years before their present hospital admission.

LABORATORY FINDINGS

The highest leucocyte count was 19,600 and the lowest 5,200. The average for the entire series was 9,276. Among the cases were two in which the count was elevated to 19,000 and 19,600. In one, the leucocytosis was due to a ruptured ectopic complicating a tuberculous salpingitis of the other side, while in the other a large ovarian abscess was present. Excluding these two the average number of leucocytes in the remaining thirty-four was 8,400.

It is said that tuberculosis produces a definite lymphocytosis.[1,2] Our observation bears out this statement. The highest percentage of lymphocytes was 50, the lowest 20, and the average for the group was 30. Our findings, however, failed to substantiate the belief that genital tuberculosis produces a secondary anemia.[2] The average hemoglobin was 78 per cent.

The sedimentation time was recorded in twenty-five cases. The most rapid reading was 15 minutes, occurring in the case complicated by an ovarian abscess. The slowest reading was 243 minutes, and the average 110 minutes. It would appear therefore that pelvic tuberculosis does not influence the sedimentation rate unless the lesion is active.

The blood pressure readings were of great interest. In all but four the systolic pressure was below 130. The highest reading was 160 and the average 104. The diastolic pressure varied between 86 and 0. The latter reading was noted in the ruptured tubal pregnancy. The average diastolic pressure for the series was 71.

In fifteen patients, *x*-ray of the chest was done either before operation or after the diagnosis was confirmed. No case showed an active pulmonary lesion. Urine analysis was essentially negative. In three patients the temperature was slightly elevated on admission into the hospital.

PREOPERATIVE DIAGNOSIS

The diagnosis of pelvic tuberculosis was made in only two instances. The presence of a unilateral or bilateral adnexal mass associated with slight pelvic tenderness led to the preoperative impression of chronic pelvic inflammation in twenty-five other cases. In each of the remaining nine patients the preoperative diagnosis was: retroversion, fibroid uterus, ruptured ectopic, ovarian cyst, menopausal bleeding, endometrial hyperplasia, cervical carcinoma, fundal carcinoma, and uterine prolapse, respectively.

TREATMENT

One woman died twenty-four days after her admission. At autopsy generalized

tuberculosis was found. The remaining thirty-five patients were operated upon and the procedures were as follows:

	Number
Hysterectomy with bilateral salpingo-oöphorectomy	13
Hysterectomy with unilateral salpingo-oöphorectomy	1
Fundectomy with bilateral salpingectomy	1
Bilateral salpingo-oöphorectomy	1
Unilateral salpingo-oöphorectomy and salpingectomy	2
Unilateral salpingo-oöphorectomy	1
Bilateral salpingectomy	1
Unilateral salpingectomy	1
Oöphorectomy	1
Diagnostic curettage	7
Amputation of cervix	2
Biopsy of cervix	2

POSTOPERATIVE COURSE

Five, or 14.3 per cent, of the patients died following operation, making a total mortality of six, or 16.7 per cent. Death following operation was attributed to generalized peritonitis in two cases, and in the remaining three the causes respectively were shock, bronchopneumonia, and myocardial failure. Other complications were infrequent. In three the wound became infected. In one case abdominal drainage resulted in a long-standing fistula which ultimately closed at the end of a year. One patient developed a parotitis, another pneumonia, while in a third parametritis complicated the course.

PATHOLOGY

While no part of the female genitalia is immune to tuberculosis,[1,2,3] our material failed to disclose a single case of vaginal or vulval involvement. The sites of infection in their order of frequency were: tubes (85.5 per cent), uterus (45.5 per cent) ovaries (16.6 per cent), and cervix (5.5 per cent).

Tubes. Grossly the tubes were thickened and covered with adhesions. In ten, minute tubercles were visible on the serous surface. As a rule the abdominal ostium was patent, though the fimbriae were frequently glued to the external walls of the organ. Large firm nodules were often seen in the interstitial portion of the tube.

The location and number of tubes involved were:

	Number Removed	Number Involved with Tuberculosis	Per Cent
Right tube	26	25	96.1
Left tube	30	24	80.0
Total	56	49	87.5

Bilateral salpingectomy was done in twenty-five of the cases and in nineteen (76 per cent) both tubes were simultaneously involved with tuberculosis.

Microscopically the tubes showed marked hyperplasia of the mucosa associated with a diffuse distribution of varying sized tubercles. The most common site of involvement was the mucosa, then the muscularis, and the serosa was least affected. In twenty, or 40.9 per cent, the infection was present in more than one coat.

Uterus. The uterine mucosa from twenty-two patients was submitted for pathologic study and in ten (45.5 per cent) tuberculosis was found.

Here the microscopic picture is similar to chronic endometritis with the additional finding of characteristically arranged tubercles and giant cells. As a rule the tubercles are miliary in size, though some coalesce with a tendency toward caseation necrosis.

Tuberculosis of the myometrium associated with endometrial involvement was observed in three cases. Though tuberculous invasion of the uterine myometrium without endometrial involvement has been reported,[3,4] we encountered no such case in our material.

Ovaries. Six (16.7 per cent) of the thirty-six ovaries removed showed tuberculosis. In one case both ovaries were

involved. The lesion was noted either in the hilum or on the surface.

Cervix. The cervix revealed tuberculosis in two cases. In one, the interstitial portion of the portio vaginalis was involved and because of ulceration simulated carcinoma, with the result that the true condition was recognized only after biopsy. Subsequent hysterectomy with bilateral salpingo-oöphorectomy failed to reveal tuberculosis in any of the organs. This case was reported by Harris.[5]

The other cervical lesion was situated in the center of the fibromuscular wall. Curettings from this case revealed a premenstrual mucosa with no evidence of tuberculosis.

CONCLUSIONS

1. A family or past history of tuberculosis is significant. In fifteen cases the family history was positive or suggestive while in thirteen the past history revealed similar information.

2. Pelvic tuberculosis occurs most frequently during active sex life; 88.8 per cent of the women were between the ages of 21 and 40.

3. The organs involved in their order of frequency were: tubes, 87.5 per cent; uterus, 45.5 per cent; ovaries, 16.7 per cent; and cervix, 5.5 per cent.

4. The disease usually starts insidiously with pain or with an alteration of the menstrual period.

5. Tuberculosis of the genitalia commonly produces absolute or relative sterility. This was manifested in thirty-two, or 88.8 per cent, of our patients.

6. A tentative diagnosis of genital tuberculosis should be made in the virgin or nullipara who presents findings of inflammation limited to the upper pelvis.

7. The diagnosis of pelvic tuberculosis can be made in almost 50 per cent of the cases from endometrial biopsy; 45.5 per cent of uterine currettings revealed tuberculosis.

8. A normal white cell count or a moderate leucopenia with slight lymphocytosis was common. The hemoglobin and sedimentation rates were normal. Low diastolic and systolic pressures were the rule.

We wish to express our appreciation to all the members of our staff who have willingly permitted us to use their cases in making this review.

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EXPERIENCES IN THE TREATMENT OF CERTAIN URINARY TRACT MALIGNANCIES WITH SUPERVOLTAGE ROENTGEN THERAPY

ARBOR D. MUNGER, M.D.

Attending Genito-Urinary Surgeon and Chief of Section, Lincoln General Hospital; Attending Urologist, Bryan Memorial Hospital

LINCOLN, NEBRASKA

FOR some time past, irradiation in some form as an adjunct in the treatment of urinary tract malignancies has become an almost universally accepted procedure. Whether radiant energy as ordinarily applied has materially altered the mortality from such sources is gravely open to question. Since the destructive effects of the Roentgen ray upon malignant cells has found clinical acceptance, it is only fair to ask the question: why have not more satisfactory results in deep malignancies been achieved? The many redoubtable phases which would have to be discussed here in an attempt to answer this question preclude wide consideration. The object of this communication is to present certain clinical observations relative to supervoltage Roentgen therapy which serve to facilitate, at least, a more hopeful prognosis.

ROENTGENOLOGIC DATA

The almost universally applied type of Roentgen irradiation is that of 200 k. v., with the Coutard technique, filtration with 0.5 mm. of copper, with a total tumor dosage ranging from 1,600 to 3,500 R, employing from two to four portals of entry. Most justifiable reports have emanated from Randall,[1] Wharton,[2] and Waters[3] in this respect. In this instance, while certain observations are based on the 200 k. v. therapy, the coincident privilege of observing the more manifest destructive effects of 650 k. v. constant potential, has been afforded. In this, filtration has been achieved through 1.25 mm. of lead, the equivalent of 10 mm. of copper, in addition to the fixed filter in the tube itself, which is ⅛ inch steel, ⅛ inch aluminum, 4 mm. bakelite, and ¾ inch water. Multiple ports are used with 300 R per area per day at 72 cm. distance. Each area receives its quota in rotation until the completion of the series; this gives 2,100 to 3,000 R per skin area. As between the two intensities, the difference in filtration is set forth in order that we might have a somewhat better understanding of the physical properties of the two intensities.

Schmitz[4] presents probably the most understandable information in this respect, and in so doing, contends for the increased effectiveness of the physical and biologic properties of the ultra short wave potentiality. He states, "The absorption of rays in a body or medium is the crux of the success in irradiation therapy." This, of course, is a readily acceptable dictum to all of us. And to support this statement in favor of the superior virtues of extreme voltage therapy in contradistinction to the medium voltage intensity, he quite conclusively depicts by physical measurements and a calibrated graph the rather limited skin erythema and depth absorption threshold of the medium voltage, as against the high rate of skin safety and markedly increased depth absorption of the ultra short wave therapy. This increased virtue of the latter in a large measure seems to be brought about through its ability to screen out, by enormous filtration, a large percentage of rays that have a detrimental effect on the skin surface, with the coincident transmission of a vastly increased amount of beneficial rays for absorption at a decidedly increased depth. My clinical and histologic observations substantiate the above statements.

PATHOLOGIC DATA

It is quite definitely accepted that various types of tumor cells vary decidedly in sensitiveness to response under irradiation. This has long been noted among tumors of varying cellular origin, but little understanding has been evinced with regard to such variance in tumors of the same cellular origin until Broder[5] detailed the significance of gradations in the degree of malignancy. Under the heretofore prevailing irradiation potentialities, these graduations with the potentialities used have served as a satisfactory prognostic index, but it is my present belief that under the adjunct of ultra short wave therapy the degree of cellular destruction as a prognostic index with respect to renal tumors will have to be accepted with some degree of reservation. Conversely, under this observation some of the less favorable types of renal tumors as pointed out by Braasch[6]—namely, the granular cell and alveolar carcinoma—have responded favorably to ultra short wave therapy. Let it not be assumed, however, that this argues for curability in these cases. Rather it signifies only that the more decided destructive effects make the extended prognosis seem more hopeful. So much cannot be said, from my observation, in cases treated with the medium voltage therapy. The striking difference of destructive effects in large renal tumors separates these two intensities very widely. The difference in destructive effects is not so much histopathological as it is gross, for wherever sufficient radiant absorption takes place in either intensity, there appears a replacement with fibrous tissue, hyalinization, and necrosis. This destructive effect, while definitely noted, is rather limited in the lesser potential. The gross extent of this change is sufficiently extensive in the higher potential that at times it almost entirely replaces the tumor mass.

Irradiation, however, is not a sine qua non or an end in itself. Surgical removal of the tumor must be instituted as expeditiously as possible. The irradiation has definitely shrunk the tumor, and, so to speak, put the malignant cells in a dormant state. While they remain in this state, the great danger, so prevalent in the past, of early metastasis from surgical manipulation, is at a minimum. Failure to remove the involved kidney will present a regrowth of a radio-resistant nature.

The decidedly high postoperative mortality in the past has been materially augmented by metastatic formation as the result of surgical manipulation of the tumor. Preoperative irradiation alone is, in my opinion, insufficient. The best results are achieved through adequate preoperative and postoperative irradiation. No harm has come about as a result of pursuing such a course and probably much good is accomplished thereby. Three cases in this limited group presented a histopathology which would have indicated an early demise. These patients were treated heroically, both before and after operation, and at the present writing are physically vigorous.

I desire to take issue with the statement by Braasch[6] that it is "necessary to wait two months following irradiation before surgical removal is attempted." In no instance has operation been delayed longer than fourteen days following preoperative irradiation, and in no instance has there been other than normal healing of all tissues.

Tumors of epithelial origin in the renal pelvis are radio-resistant, and because of this it is felt that very little effect can be achieved by irradiation. These are also the cases which often present obstruction and infection, and it is deemed improvident to subject them to deep *x*-ray treatments.

CLINICAL DATA

In those cases in which the general health seems to have been relatively little affected by the tumor, irradiation is begun immediately. There is, however, an occasional patient who, because of hematuria and toxemia, shows marked anemia and physical depletion. Here one or two blood

transfusions have a decidedly stabilizing effect.

During the course of irradiation, which lasts nominally twenty-eight days, the patient is, of course, under constant medical supervision. Every effort is put forth, by diet, tonics, and other means, to rehabilitate him to the greatest degree. Early relief from subjective symptoms, such as pain, is manifest after the first few treatments. Likewise, any bleeding is readily controlled. Systemic reactions are mild; nausea, vomiting, and loss of appetite are infrequent. A repeated check is kept on the blood findings, so that should anemia or leucopenia threaten, liver extract injections can restore the hematopoietic balance. Gastrointestinal symptoms are not infrequent as the result of an early enteric mucositis. This as a rule is not unduly disturbing and recedes about the second or third week, following which the appetite returns and the patient again enjoys eating. Such erythema as is seen presents itself by burning and itching of the skin, and usually appears about the fifteenth or twentieth day. It is peculiarly free from exfoliation and induration.

Contrary to the experimental work presented by Hagner and Coleman[7] relative to permanent damage through irradiation to other vital organs of the body, and especially to the opposite kidney, it is felt that no undue concern need be felt in this respect. This has been amply covered in a previous communication of mine.[8]

A word about transperitoneal nephrectomy may be added here. The time-honored custom among urologists is to carry out operative procedures on the kidney through a lumbar incision. The urologic surgeon seems to have an unwarranted fear of the abdominal cavity, presumably a heritage from the pre-antiseptic era. Yet the transperitoneal operation in renal tumors is without the inconveniences surrounding a lumbar nephrectomy. The access to the kidney and to its vessels is greatly facilitated, and to be able to work under the guidance of the eye is decidedly advantageous. In so far as the visibility of the operative terrain and the accessibility of the renal vessels are concerned, the transperitoneal nephrectomy has an undeniable advantage over the lumbar operation. Nor can I concur in the assertion that patients die of shock following transperitoneal nephrectomy. On the contrary, shock is less and convalescence much smoother.

A long pararectus incision with mesial packing of the intestines and section of the posterior peritoneum, lateral to the large intestine, exposes the capsule of the tumor, and careful dissection around the hilus exposes the renal vessels which can be ligated before one handles the tumor to any appreciable extent. Hemostasis is excellent and the abdominal cavity is closed tightly in a reverse manner. Drainage is achieved by retroperitoneal counter drainage through the flank only.

REPORT OF CASES

To amplify the foregoing statements, a series of seven malignant renal tumors is herewith presented. The seven patients were cared for during the two years ending June 1936. They are divided into three groups: (1) those receiving postoperative irradiation only (two cases); (2) one who received irradiation, but no operation; and (3) those receiving both preoperative and postoperative irradiation.

GROUP 1: POSTOPERATIVE IRRADIATION ONLY

Case 1. Mrs. J. McN., aged 45 years, was admitted to the Lincoln General Hospital June 11, 1934, with complaints of intermittent hematuria for three months and easy fatigue. The diagnosis was right renal tumor.

Urinalysis revealed the following: specific gravity 1.014; alkaline reaction; straw color; no sugar, albumin, or casts; and an occasional white and red blood cell. Blood urea was 30 mg. per cent. Urine obtained by ureteral catheterization showed the following: specific gravity 1.008; albumin 2 plus; a trace of sugar; occasional granular casts; red blood cells 1 plus; appearance of phthalein in nine minutes;

2.5 per cent output in fifteen minutes. The left side was negative. There was appearance of phthalein in four minutes, 18 per cent in fifteen minutes. During the first hour, the total phthalein output was 40 per cent, during the second hour, 15 per cent, bringing the two hour total to 55 per cent. Blood pressure was 120/74. The red blood cells numbered 4,500,000, white cells 9,450: the hemoglobin was 80 per cent.

The husband refused the recommendation of the advisory board for radiation therapy. Transperitoneal nephrectomy was therefore performed June 13, 1934, and the immediate recovery was uneventful.

A pathologic report by Dr. J. Marshall Neely, Jr., showed, "adenocarcinoma, renal, granular cell."

Following operation, the husband, having apparently made inquiry concerning *x*-ray therapy, requested that his wife be given treatment with 200 k. v. therapy. Accordingly, irradiation was carried out over the right side of the abdomen through three ports, each area receiving 950 R. or a combined total of 2,850 Roentgen units.

On August 16, 1934, urinalysis was normal; the phthalein output: first hour 45 per cent, second hour, 15 per cent, two-hour total, 60 per cent. The blood urea was 28 mg. per cent; blood pressure, 124/70. At this time the radiologist advised that the patient receive a second course of postoperative irradiation. This was not done, however, until, on October 10, 1934, the patient returned showing marked loss of weight and physical depletion. An *x*-ray of the chest at this time revealed multiple metastases, and the patient died from metastases on November 24, 1934.

Comment. It is definitely felt in this instance that the patient's best chances were lost by the refusal of her husband to accept preoperative irradiation. Histologically this was an especially virulent tumor. At operation it appeared will confined to the kidney but decidedly large in extent. Treatment in this instance as heretofore mentioned was with a 200 k. v. machine. Whether or not ultra short wave irradiation would have been more beneficial is entirely conjectural, but I doubt that it would. I believe that metastatic dissemination occurred probably at the time of the operation. Postoperative irradiation offers no better results than operation with no irradiation.

Case II. L. H., a male, aged 6 years, was admitted to the Lincoln General Hospital on February 12, 1936 complaining of hematuria for six weeks. Diagnosis was established as right renal tumor.

Urinalysis revealed the following: specific gravity 1.020; acid reaction; a trace of albumin; 1 plus white blood cells; and 1 to 2 red blood cells. Blood urea was 22 mg. per cent. Phthalein output the first hour was 40 per cent, the second hour 25 per cent, with a two-hour total of 65 per cent. The red blood cells numbered 4,560,000 and the white blood cells 8,900. Hemoglobin was 78.9 per cent, and the blood pressure 78/50.

Irradiation was recommended but refused. A transperitoneal nephrectomy was performed February 16, 1936, and the immediate convalescence was uneventful. The pathologic diagnosis by Dr. Neely was embryonal adenosarcoma. Following the operation, the father requested that the little patient undergo a course of irradiation. Accordingly, 200 k. v. therapy was started on March 17, 1936, and continued until April 2. The patient received a total of 3,980 R. So-called *x*-ray sickness was of passing moment only and the boy continued to gain weight during the treatment period. This little patient made a most remarkable physical improvement during the next two or three months. He gained until his vigor was at par. In the latter part of June, however, he began to slip suddenly, and an *x*-ray picture revealed metastasis in the lungs. He rapidly lost weight and died about thirty days later.

Comment. Here again the utter futility of postoperative irradiation is exemplified. The tumor was a sharply circumscribed, well-localized, radiosensitive growth, and from the rapid physical improvement following nephrectomy, I will always feel that this little boy probably lost his best chance of recovery by not having preoperative irradiation. There was no evidence of metastasis prior to operation. I feel so strongly about the advantage of preoperative irradiation in such cases, that I have subsequently refused to operate unless

there is a thoroughgoing course of preoperative irradiation of sufficient magnitude to achieve maximum reduction of the tumor.

GROUP II: IRRADIATION ALONE

Case III. T. A. S., a male farmer, 69 years of age, was admitted to the Lincoln General Hospital December 30, 1935, complaining of general weakness with an acute retention of urine. He had been catheterized three times daily for the previous week. There has been intermittent hematuria for the past two years. The urine at the time of admission contained a large amount of blood. There was a general arteriosclerosis and the electrocardiogram revealed coronary disease.

The blood urea was 65 mg. per cent, and the urine contained many pus and red blood cells, and was badly infected with mixed organisms. There was a large mass in the left flank. Under suprapubic drainage, the blood urea was reduced to within normal limits, and the infection was materially eliminated.

Cystoscopy at this time revealed a papillary tumor on the right side of the bladder in the region of the right ureteral ostium, and pyelogram of the left kidney revealed *x*-ray findings of a renal tumor. Likewise, there was a benign hypertrophy of the prostate. Accordingly, this patient was given 7,500 R with a 650 k. v. machine over the left kidney, causing a rapid reduction in the size of the tumor and cessation of bleeding from the left kidney. Following the *x*-ray treatment, a resection was done and the patient was sent home, as it was deemed inadvisable to attempt nephrectomy in view of the extensive arteriosclerosis and coronary disease.

The patient was not heard from again until August 11, 1936 at which time examination revealed a recurrence of the tumor mass in the left flank. Throughout the period of time, however, from February 29 until the first part of August 1936, the patient had actively conducted his farm work. When the recurrence was noted it was deemed inadvisable to institute further therapy, as the patient evidenced metastasis in his lungs. This situation gradually progressed until December 17, 1936, when he died a cerebral death. No autopsy could be obtained.

Comment. In this instance the futility of *x*-ray alone, to the exclusion of surgical intervention, is well exemplified. It is presumed that a renal tumor presenting itself in a man of this age would be of a relatively low-grade virulency, and should this man have been a good operative risk on recession of the tumor following irradiation, he probably could have achieved perfectly good results.

GROUP III: PREOPERATIVE AND POSTOPERATIVE IRRADIATION

Case IV. Dr. M. J. B., aged 46 years, was admitted to the Lincoln General Hospital January 19, 1935, complaining of an attack of hematuria the day before admission. A diagnosis of left renal tumor was made.

The urine was bright red with blood. The blood urea was 32 mg. per cent. No urine could be obtained from the left kidney by catheterization, and on the right side the urine was slightly granular. Microscopic study showed only an occasional white blood cell, epithelial cell, and granular cast. On the right side the phthalein appeared in five minutes with an output of 12 per cent in fifteen minutes. The red blood cells numbered 5,240,000, white blood cells 7,200, and the hemoglobin 74 per cent. The blood pressure was 152/80.

The case was one of a left renal tumor with a moderate elevation in blood pressure and blood urea nitrogen. The right kidney showed a moderate nephritis. The advisability of preoperative deep therapy was discussed with the patient. In view of the fact that there was evidence of a definite degenerative change in the right kidney, some hesitancy was felt by the advisory board in urging irradiation. The patient, however, elected to undergo treatment. He informed us that he had had albumin and casts in his urine intermittently since 1931.

Accordingly, he was given 8,400 R skin dose with the 650 k. v. machine through three ports to the left kidney. The bleeding promptly ceased. Throughout the preoperative irradiation period the red and white blood cell counts and the hemoglobin fluctuated inappreciably from the starting level. Urinalysis continued to show albumin and casts. The two-hour phthalein curve ranged from 45 per cent to 60 per cent, and the blood urea from 30 to 42 mg. per cent. Liver therapy was given intramuscularly every

other day and an occasional intravenous injection of 10 per cent glucose in normal salt. There was surprisingly little systemic upset, and when this did occur, an intravenous injection immediately relieved the difficulty. A transperitoneal nephrectomy was performed March 9, 1935, two weeks after the deep *x*-ray therapy had been discontinued. Recovery was uneventful. The pathologic diagnosis was adenocarcinoma, renal, granular cell.

The second series of 8,400 R skin dose was given beginning in May 1935. Throughout this second series, while very little effect was noted in the functional capacity of his single kidney (with its known nephritis), it was definitely more difficult to maintain the integrity of the hematopoietic system. Very close check on the integrity of the only kidney was maintained throughout the succeeding months. There was no appreciable alteration until July, but from July 1935 to January 1936 an evident delayed embarrassment of the kidney occurred, manifested by a decided heightening of the nephritic syndrome. This gradually subsided, however, and since January 1936, the urine has shown only an occasional trace of albumin and no casts. The blood pressure is about 145 or 150. The urine concentration is good, and the blood urea nitrogen ranges from 25 to 30 mg. per cent, with the phthalein excretion about 30 per cent for the first hour, and 20 per cent for the second hour (from the single kidney). There is no evidence of metastasis up to the time of the present writing. From the standpoint of histopathology, this tumor falls in the class of one of the more highly malignant grades, for which ordinarily a bad prognosis is expected. While it is too early to judge the ultimate result in this case, now, after two and one-half years, it does seem that the outcome is more hopeful than if irradiation had not been done.

Case v. M. J. W., aged 55 years, was admitted to the Lincoln General Hospital March 23, 1935, complaining of indigestion and a mass in the left flank. The diagnosis was left renal tumor.

The urine showed a specific gravity of 1.025; alkaline reaction; no sugar or albumin. Microscopic examination showed a few white blood cells, red blood cells, hyaline and granular casts. The blood urea was 40 mg. per cent. Urine obtained by means of ureteral catheterization from the right side was granular, containing an occasional white blood cell, red blood cell, hyaline and granular casts, and a trace of albumin. Phthalein appeared in three minutes with a 20 per cent output in fifteen minutes. Urine obtained from the left side was granular with an occasional white and red blood cell, a trace of albumin, and a few hyaline and granular casts. The phthalein appeared in seven minutes with an output of 5 per cent in fifteen minutes. Red blood cells numbered 4,980,000, the white blood cells 8,950 and the hemoglobin was 95 per cent. The blood pressure was 158/85.

A left renal tumor was present, accompanied by evidence of nephritis in both right and left kidneys. The blood urea was moderately elevated, and although the appearance time was normal, the left kidney was materially depressed. The blood pressure was slightly elevated. Notwithstanding the nephritis, it was the consensus of opinion of the advisory board that the patient be referred for preoperative irradiation. Between March 26 and April 26, 1935, the patient received 8,400 R skin dose of 650 k. v. deep therapy. During the period of irradiation, there was no alteration in the blood chemistry, kidney function, and urine studies.

On June 25, 1935, the patient was reëxamined by the Cancer Advisory Board. Urinalysis, phthalein test, and blood chemistry showed no appreciable alteration. A second course of irradiation was recommended. It continued from June 26 to August 8, the patient receiving 8,400 R through three ports. He then returned home and nothing further was heard from him until January 13, 1936, five months after irradiation, when he returned complaining of extreme fatigue. He was pale and pasty, and there was edema of the ankles and face. Urinalysis showed 3 plus albumin, and an occasional white and red blood cell. Red blood cells numbered 3,180,000, and the white blood cells 10,200. The hemoglobin was 70 per cent. The blood pressure was 162/88, and the blood urea was 52 mg. per cent. The patient presented a marked depression of his remaining kidney. He was put under active treatment for the nephritis, until May 6, 1936, when urinalysis disclosed a trace of albumin and the blood urea 50 mg. per cent. The blood pressure was 158/80, and phthalein test showed an output of 35 per cent the first hour and 35 per cent the second hour, making a two-hour total of 70 per cent. At this period and up to the present time the patient has not presented metastasis.

Comment. From the histopathology it is definitely evident that this patient had a very high grade malignancy. This malignancy, likewise, was extremely radiosensitive, as manifested by the very rapid regression throughout the preoperative irradiation. During the second irradiation series and for several weeks following, gross insult was manifested in the functional capacity of the remaining nephritic kidney. This state endured for several weeks, and gradually regressed until at the present time the renal integrity is on a level with that when first admitted. It is of interest to note that this depressant action on the functional capacity of the kidney has not been noted in other patients who have received similar amounts of radiant energy through the abdominal region for other deep-seated malignancies. It is our thought that in some way this reaction is motivated through irradiation insult to an already over-burdened nephritic kidney struggling to compensate. The advisability of future postoperative irradiation in a subject with a known degenerative process in the single kidney is gravely open to question. This particular patient remains well at the present time and shows no deleterious by-effects from his irradiation.

Case vi. B. A. T., aged 32 years, was admitted to the Lincoln General Hospital on February 2, 1936, complaining of intermittent hematuria for three months. The diagnosis was left renal tumor.

The urine showed a specific gravity of 1.028, acid reaction, 1 plus albumin, 1 plus white blood cell, and 4 plus red blood cells. White blood cells numbered 9,250, and the hemoglobin was 80 per cent. The blood pressure was 130/74, and the blood urea 24 mg. per cent. The phthalein output was 55 per cent the first hour and 15 per cent the second hour, making a two-hour total of 70 per cent. Urine obtained from the right side by means of ureteral catheterization was clear. Phthalein appeared in three minutes, and 20 per cent was eliminated in fifteen minutes. Urine obtained from the left side was smoky. The phthalein appeared in eight minutes, and it was impossible to determine the amount eliminated in fifteen minutes.

Preoperative irradiation was recommended; accordingly the patient received 2,100 R skin dose to each of three ports, or a total of 6,300 R, 650 k. v. therapy. On March 3, 1936, urinalysis, blood chemistry, kidney function, and blood pressure were all within the normal range. A transperitoneal nephrectomy was performed March 6, 1936. Recovery was uneventful. Pathologic report was adenocarcinoma, renal (type unstated). This tumor did not show a pronounced reduction in size as did those heretofore noted; although there was very marked necrosis throughout the major portion of the tumor. On the other hand there was not a great deal of fibrous tissue replacement.

On March 16, 1936, the urine, blood chemistry, and kidney function appeared normal. It was recommended that a postoperative irradiation series be begun. On March 24, after 2,400 R had been given, the single kidney began to show hyaline and granular casts, pus and albumin. The phthalein output was depressed to 35 per cent in two hours. Treatments were stopped, and no further depression occurred. At the end of ten days normal physiology was evident. It has remained so to the present time. No metastasis has developed, and there have been no deleterious by-effects, from the irradiation. So far the patient has remained in good health.

Comment. This case presents probably a kidney tumor of low virulence. Postoperative irradiation was instituted in this instance, but it is questionable whether it was necessary. This, of course, raises the question of whether it is necessary in any case that has had adequate preoperative irradiation. It is my feeling that in the preceding cases postoperative irradiation has been carried, for the most part, to too great an extent and as time progresses, we will probably arrive at some happy medium in this respect.

Case vii. Miss B. J. T., aged 14 years, a school girl, was admitted to the Lincoln General Hospital on May 5, 1936. Her chief complaint was that of extreme weakness, with loss of weight and palpable tumor mass in the left flank.

Urinalysis revealed the following: Specific gravity 1.017; acid reaction; smoky; no sugar; albumin 1 plus; and many pus cells. Phthalein

output the first hour was 50 per cent, the second hour 10 per cent. Differential phthalein was not done. Blood urea was 26 mg. per cent. The red blood count was 3,560,000, the white blood count 8,100, and the hemoglobin 98.4 per cent. *X*-ray examination of the chest was negative.

Prior to irradiation and operation it was deemed that this was an ordinary adenosarcoma of the kidney (Wilm's tumor). But it was quite evident during irradiation that the tumor did not exhibit the radiosensitive qualities of the ordinary Wilm's tumor, and while very definite hyalinization and necrosis were noted at the time of operation, the tumor was definitely not reduced in size in keeping with our experience with other Wilm's tumors. The pathologist's report was adenocarcinoma, renal, (clear cell). At the time of and during the operation (which was done transperitoneally), it was noted that the second lumbar vertebra was decidedly enlarged and nodular, as though it might be the site of a metastatic focus. Subsequently a review of the urogram studies very definitely revealed a metastatic deposit in the second lumbar vertebra which had been overlooked primarily.

According to the pathologist the tumor was of an adult type, and one wherein a good prognosis can ordinarily be entertained. However, in this instance it had already metastasized into the lumbar vertebra prior to the irradiation and operation. In spite of this, the patient was given postoperative irradiation, from June 20, 1936 to August 5, 1936. She received 4,800 R with a 650 k. v. machine. The little girl did very well at first, but in the latter part of October she began to show signs of physical depletion, and she finally died on December 19, 1936. An autopsy revealed recurrent malignancy in the operative area with multiple metastasis in the liver and lungs, involvement of the hilum and the free tracheal lymph nodes with destruction of the second lumbar vertebra.

Comment. This little patient presented not the usual embryonic tumor we would expect to find in such a youngster, but rather more of a Grawitz type of tumor, and one of the lower grade of virulence. However, the metastasis had taken place before the diagnosis was made. In this case if proper diagnosis with irradiation and surgical intervention could have been achieved before metastasis had taken place, because of the type of tumor present, it is quite possible that the outcome would have been excellent. Here is well exemplified the utter futility, I believe, of preoperative and postoperative radiation in any type of renal tumor which has already metastasized. This little girl would not have been operated on had we been more keen and noted the metastatic focus in the lumbar vertebra before hand.

SUMMARY

1. Preoperative irradiation as an adjunct in the treatment of renal tumors is a definite step forward.

2. Where possible, irradiation with the ultra short wave potential is definitely superior to medium voltage therapy.

3. Postoperative irradiation alone does not enhance the prognosis.

4. Adequate preoperative irradiation with limited postoperative irradiation argues for the best prognosis.

5. Irradiation and operation in the presence of established metastasis is futile.

6. Irradiation without surgery is futile.

7. Transperitoneal extirpation of the irradiated tumor greatly facilitates the ease of operation.

8. Under the above régime the curability of renal tumors is not asserted, but it is felt that the prognosis is more hopeful.

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THROMBOPHLEBITIS OF THE PENIS AND SCROTUM*

MORRIS ROBERT KEEN, M.D. AND SOL SHLIMBAUM, M.D., F.A.C.S.

Urologist, Southside and Huntington Hospitals; Consulting Urologist, Kings Park State Hospital

HUNTINGTON, NEW YORK

Attending Surgeon, Southside Hospital

BAY SHORE, NEW YORK

OF many standard urologic works examined, the subject of thrombophlebitis of the genitalia is briefly mentioned by only one author (Hinman). Cases illustrating occlusion of the blood supply to the penis of more or less sudden onset—with or without a resultant, persistent erection—have been sporadically reported. These lesions vary from a partial involvement of the dorsal vein to a diffuse clotting of the blood spaces of the corpora cavernosa.

The following case was thought sufficiently interesting to warrant reporting:

M. L., age 25, a law student, referred by Dr. Lichtenfeld (Lake Ronkonkoma, New York), was admitted to the Southside Hospital, Bay Shore, New York, on March 4, 1936, complaining of difficulty in voiding, of a swollen, erect penis and swollen scrotum, of three days' duration. Sexual excesses or alcoholism were vigorously denied.

The patient's general health had always been good. About a month before admission he had contracted a sore throat which later developed into the grippe. During this time he experienced a painful swelling of the left calf muscle which receded upon administration of the usual supportive measures.

Physical examination revealed an apprehensive male adult, acutely ill. His temperature was 103, pulse 88, respirations 20. The cardiovascular system was negative.

Positive findings were a bladder distended to the umbilicus. Both penis and scrotum were the sites of marked edema and swelling (about two and one-half times normal). The overlying skin presented a bluish-black hue. The penis was in a constant state of erection and acutely flexed toward the abdomen. Both corpora were indurated but not tender. A small, circular area of gangrene was seen on the lateral surface of the prepuce. The prepuce itself could not be retracted. No lymphadenopathy was present. In addition there was some tenderness present in the left popliteal space. Rectal examination revealed a small, soft prostate.

Laboratory data were as follows: Blood count: Hgb. 37 per cent; R. B. C. 2,500,000; W. B. C. 19,000; polymorphonuclears 80 per cent. Urine: occasional leucocyte. Wassermann: negative. Blood chemistry: normal. The two blood cultures taken proved to be sterile.

Course. The gangrenous area along the lateral surface of the prepuce increased in size, reaching a diameter of 1½ inches. On the sixth day this necrotic area separated, leaving a clean-edged, circular opening through which a black glans could be seen. The erection, swelling, and discoloration of the penis and scrotum began to recede on the seventh day, and the latter gradually assumed a normal appearance on the fourteenth day. In the interim the glans of the penis had herniated through the lateral opening of the prepuce. The border of the wound had united with the skin of the prepuce at the coronal edge of the glans. The ultimate appearance was that of two glans attached to the shaft of the penis. (Figs. 1 and 2.)

Associated with this thrombotic lesion were fleeting pains in the right kidney area, upper right quadrant of the abdomen, and tender swellings of both legs with purple discoloration of the skin over the calf muscles. No pulsation of the left popliteal artery could be felt. The swelling and discoloration of the skin of the right leg subsided spontaneously. The skin of the belly of the left gastrocnemius muscle became gangrenous, the swelling of the left leg increasingly tender. Within a few days, a large, gangrenous slough of the skin was removed, and about two-thirds of the belly of the gastrocnemius muscle was found to be necrotic under this gangrenous area. This necrotic muscle tissue was also removed, leaving

* Presented before Section of Genitourinary Surgery, New York Academy of Medicine, April 21, 1937.

a deep, discharging cavity which healed very slowly. (Fig. 3.)

The temperature during the illness ranged from 102 to 103 degrees for four weeks and finally subsided to normal when all infective material had been cleared.

Treatment consisted of daily catheterization, wet dressings, débridement of tissue, fluids, and medication for the marked anemia.

At the end of the sixth week, the patient viewed the strange appearance of his two-headed organ with alarm and distress. Consequently the prepuce was resected, although the commercial possibilities of leaving it alone were stressed.

The patient was discharged seven weeks after admission with a penis of normal appearance, good urinary function, but a slow-healing cavity in the left calf muscle.

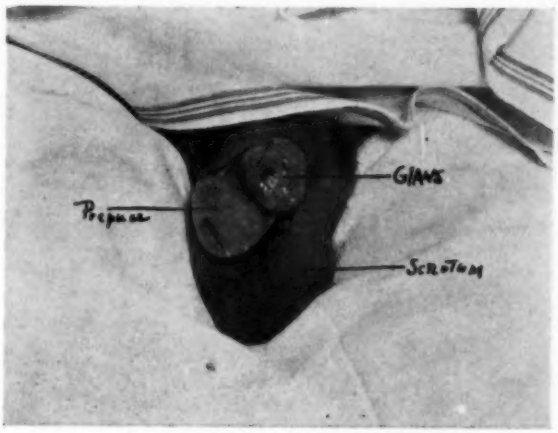

Fig. 1. Appearance of the penis six weeks after onset.

Cases illustrative of dorsal vein involvement have been reported by the following:

Turkus in 1917 noted the hard, tense, tender, cord-like character of the deep dorsal vein of the penis associated with a moderate edema of the foreskin in an 18 year old male with an active urethral Neisserian discharge. Bilateral inguinal lymphadenopathy was present. The temperature ranged about 100°F. The lesion responded to simple wet dressings.

Thieme, in 1925, described two cases of small thrombosed areas (0.5 cm.) limited to the prepuce in patients about 30 years of age; one developed the lesion after sexual excesses, the other following a Neisserian infection. The appearance of the lesion in one patient was that of a slightly swollen, red streak along the dorsum of the penis and extending to its root. This ultimately resolved into a bluish-red, slightly tender, pea-sized nodule. No lymphadenopathy was noted. The other case presented an S-shaped, smooth, hard,

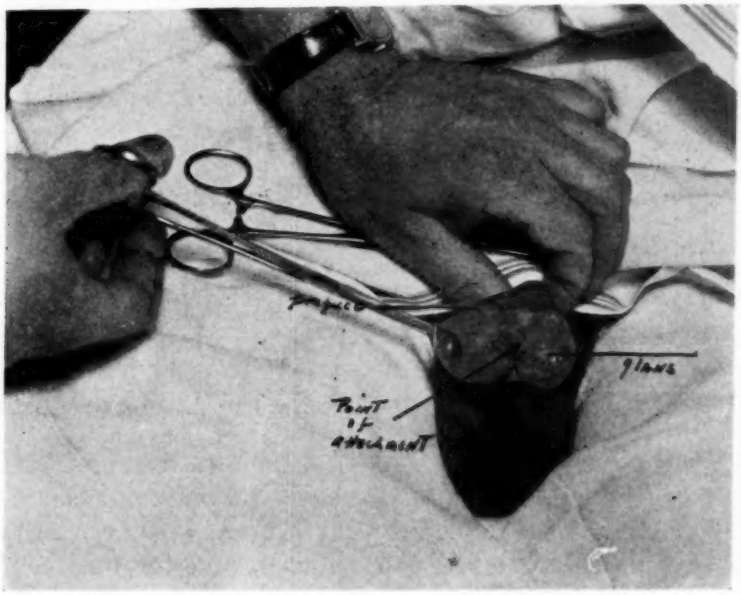

Fig. 2. Note point of attachment between glans and prepuce.

painless nodule. Both lesions responded to simple wet dressings.

J. L. Morton (1934), quoted by Morson, noted thrombosis of the dorsal vein in a case of luetic arteriosclerosis.

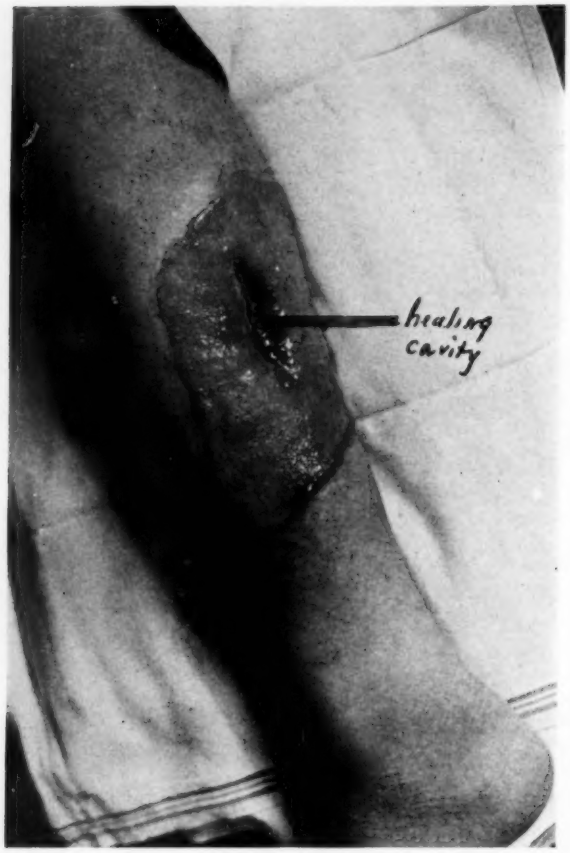

Fig. 3. Healing cavity within the left calf muscle. Note extent of skin granulation.

These lesions are of clinical importance in that a differential diagnosis must be made from chancre, chancroid, or periurethral abscess with perforation.

Thrombotic lesions of the corpora cavernosa have been observed by the following:

Challier and Gotte (1914) reported two attacks of priapism following sexual excesses which occurred in an individual who had had a phlebitis of the left leg three years previously. This resulted in a peculiar venous dilatation of the lower abdomen and left groin. The first attack cleared spontaneously within forty-eight hours. The second attack persisted for eight days. Relief was obtained by incision of the corpora cavernosa with evacuation of the clot. The cultures were sterile. Functional activity of the penis was permanently impaired.

Esteves and Chiapari (1917) reported persistent erections in a 55 year old male, relieved only by aspiration of the corpora cavernosa.

Graves (1927) cites the case of a 43 year old male who, following an upper respiratory infection, developed an erected penis with tender, enlarged corpora. There was no involvement of the glans or corpora spongiosa. Sexual excesses or alcoholism were denied. The erection persisted for fourteen days, and was finally treated by corporal incisions with evacuation of a tar-like substance resembling old blood. Cultures were sterile. Erectile powers of the penis returned to normal even though the corpora were found to be mere shells.

Morson (1934) reports two interesting cases of thrombosis associated with arteriosclerosis in relatively young adults. The first case was in a man of 35 in whom the entire penis up to the bulb became erect and swollen within three days. There was no involvement of the glans. The superficial blood vessels of other portions of the body presented marked thickening. The blood studies and the Wassermann were normal. Blood pressure varied from 130 to 140 systolic. The second case—about 40 years of age, ran a parallel course. Spontaneous remission occurred in both within a month. Functional results were poor in one.

R. J. V. Pulvertfat (1934) described a case of myeloid leucemia in which the first symptom was an erected swollen penis. This lasted for fourteen days, eventually responding to radiation of the penis and spleen. Impotentia resulted. Death occurred within two years.

One can better interpret the thrombotic lesions described above by a brief survey of the blood supply to the penis and scrotum (Cunningham). The veins of the penis are composed of a superficial and a deep dorsal set: (a) The *superficial* dorsal vein receives

its tributaries from the prepuce, runs backward immediately beneath the skin to the symphysis. Here it divides into two the prostatic vesical plexus (Santorini) which communicates with the hypogastric vein.

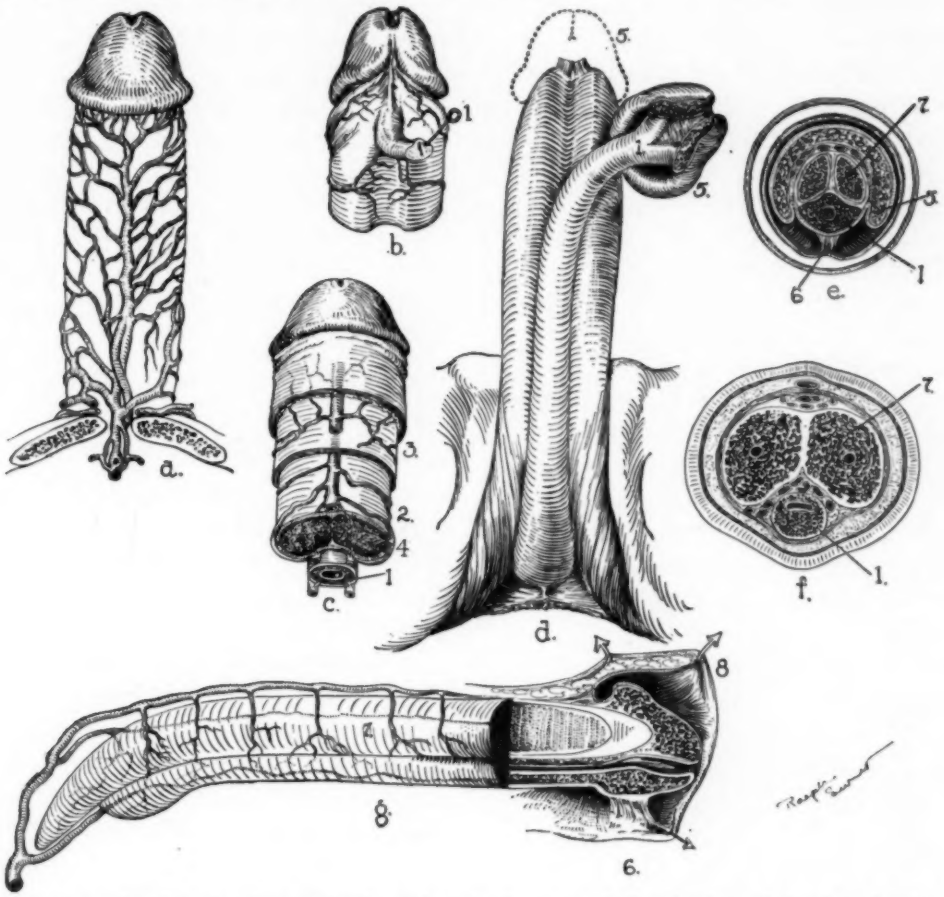

Fig. 4. *a*, the dorsal vein and its branches. *b*, the ventral distribution of the dorsal vein. The corpus spongiosum has been dissected free and is held up (1). *c*, diagrammatic representation of the venous circulation. 1, Branches from the corpus spongiosum entering the bulbo-urethral veins. The superior veins drain into the inferior veins of the corpus cavernosum. 2, Branches of the deep dorsal vein. 3, Branches of the superficial dorsal vein. 4, The anastomosis between branches of the deep dorsal vein and the inferior veins of the corpus cavernosum, giving off a lateral branch into the globus. *d*, the relation of the corpus spongiosum with its glans and bulb to the corpora cavernosa with blunt ends and forked rami. *e*, a cross section of the penis through the glans portion. 1, Corpus spongiosum. 5, Lateral lip of glans. 6, Frenulum of prepuce. 7, Corpus cavernosum. *f*, cross section of the pendulous portion. *g*, the arterial circulation showing the dorsal artery and the perforating cavernous branch and its bulbous branch extending on up into the frenulum. 8, Prepuce retracted.

branches which empty into the saphenous vein as the superficial external pudendal plexus. (b) The *deep* dorsal vein is formed by the junction of tributaries from the glans and the anterior portion of the corpora cavernosa. It follows the dorsal groove of the organ, passes between the layers of the suspensory ligament, then proceeds between the subpubic and the triangular ligament. Eventually the vein merges with

The chief arterial supply of the penis consists of branches of the internal pudendal arteries which come from the hypogastric artery. These branches supply the body of the corpora cavernosa with a central stem and superficial piercing twigs through the fibrous sheaths of the corpora. The corpus spongiosum urethrae receives its supply from the artery to the bulb.

It should be noted that a small portion of the skin and subcutaneous tissue are supplied by twigs of the superficial and deep external pudendal artery, a branch of the femoral artery.

The scrotal arterial blood supply consists of: (a) *external* pudendal branches of the femoral artery which supply the upper and anterior surface of the scrotum; and (b) *internal* pudendal branches of the hypogastric which supply the posterior surface of the scrotum. The venous supply parallels the arteries, emptying into the internal pudendal and saphenous veins.

Morson alone calls attention to the absence of glans swelling in the erected penis associated with thrombosis of the corpora cavernosa. Physiologic erection associated with sexual stimulation always presents a swollen glans. In our own case, while the superficial skin of the glans was necrotic, swelling was not observed.

Nevertheless, a study of the anatomy of the glans reveals that it too is composed of erectile tissue with the skin as its only covering. Since the dorsal vein receives as one of its branches, tributaries from the glans (Cunningham), it is reasonable to assume that thrombosis of the glans may coexist with a similar lesion in the corpora cavernosa. (Fig. 4.)

Etiology. In discussing the causative factors leading to the thrombosis of the penis, Morson enumerates three diseases:

1. Malignancy of the left kidney: the spermatic vein enters the left renal vein at right angles. Any tumor involvement of the renal vein or artery automatically obstructs the return flow and consequently enlargement of the penis and scrotum follows.

2. Leucemia (myeloid) has a known tendency for thrombosis of blood spaces, i.e., the spleen. The corpora cavernosa offer a fertile field for this process.

3. Arteriosclerosis, both simple, and luetic.

To these may be added the following:

4. Sexual excesses in individuals with preëxisting local varicosities.

5. Infection, either local, as gonorrhea (Turkus), or systemic (upper respiratory), as suggested by Graves, Keen, etc.

Treatment. In infections (local and systemic), simple wet dressings to the parts suffice. When arteriosclerosis is the underlying factor, absorption of the clot may occur spontaneously or with iodide therapy. Resolution of the organ, in other cases, may be accomplished only by incision of the corpora and evacuation of the clots (Graves, Challier, Esteves, etc.). If leucemia is the source of the thrombosis, radiation of the penis and spleen, as reported by Pulvertfat, is of benefit.

SUMMARY

1. Ten cases of thrombophlebitic lesions of the penis are reviewed.

2. To this series is added an interesting case of extensive thrombosis of the penis and scrotum in a 20 year old male, which appeared to be secondary to an upper respiratory infection. Some of the occluded blood vessels were small arteries, resulting in an extensive necrosis of an area in the prepuce and gastrocnemius muscle. While cultures were sterile, it is felt that a septicemia did occur.

3. The etiology and treatment of various types of penile thrombotic lesions are discussed.

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THE VALUE OF BLOOD DIASTASE IN THE DIAGNOSIS OF COMMON DUCT STONE*

CHARLES D. BRANCH, M.D. AND ROBERT ZOLLINGER, M.D.
Associate in Surgery, Harvard Medical School

PEORIA, ILLINOIS BOSTON, MASSACHUSETTS

THE frequency of common duct stones in cases of cholelithiasis makes it imperative to use all available methods, both before and at the time of operation, which might suggest their presence to the surgeon. In addition to the usual laboratory methods, foreign investigators have been enthusiastic as to the diagnostic value of urine diastase determinations in these cases. Although we have been finding an incidence of over 20 per cent of common duct stones, we were anxious to add any diagnostic procedure which might be of practical value. Since Foged[1] of Copenhagen has stated that an increase in urinary diastase occurred in 61 per cent of cases of stones in the common bile duct it seemed that this rather complicated procedure should be more widely used.

METHOD

It was decided to determine the amount of diastase in the blood rather than in the urine since it is more rapidly broken down in the latter. There are several methods which may be used to estimate the blood diastase. (Myers and Reid.[2]) In a general laboratory in which it is possible to do blood sugar determinations, an accurate and fairly rapid blood diastase estimation can be made by measuring the amount of reducing sugar formed by the hydrolysis of starch.

The determinations in this study were made by a method, slightly modified, which was described by Somogyi.[3] The principle of this method is dependent upon the inversion of starch to dextrose. A starch paste is used instead of soluble starch solution because we found, as Somogyi[4] did, great variations with the latter solutions.

Five cubic centimeters of fresh starch paste is made in a concentration of 1 per cent. To this is added 2 c.c. of 1 per cent sodium chloride solution which acts as a buffer. One cubic centimeter of plasma is then added and the mixture is incubated for a period of thirty minutes at 40°C. The amount of reducing sugar is determined before and after incubation by the Folin-Wu[5] copper sulphate method, and the difference is taken as the amount of reducing sugar formed by the action of the diastase. The amount of reducing sugar is then calculated for 100 c.c. of blood, and this is taken as the diastase index. We found that in normal individuals this varied between 80 and 180 mg. per cent for 100 c.c. of serum. In checking these results in dogs it was found that there was a much higher index, varying from 450 to 500 mg. per cent.

CLINICAL DISCUSSION

Foged of Copenhagen and Millbourn of Lund have made rather extensive studies of the urine diastase in connection with common duct stone, and also as an aid in the differential diagnosis in cases of jaundice. Foged,[6] in a series of papers, came to the conclusion that diastasuria was increased in about 60 per cent of the cases which had proved stones in the common bile duct. He found that there was a pathologic increase in about 15 per cent of cases of cholecystitis and uncomplicated cholelithiasis, but that in these cases diastasuria showed an increase only in moderate amount, while in cases of common duct stone there was a

* From the Surgical Clinic of the Peter Bent Brigham Hospital and the Laboratory of Surgical Research, Harvard Medical School.

high diastase value. In the differential diagnosis of icterus he found that it was of great value in differentiating between

Millbourn,[7] in 1936, also reviewed a series of cases in which the diastase determinations were used to differentiate be-

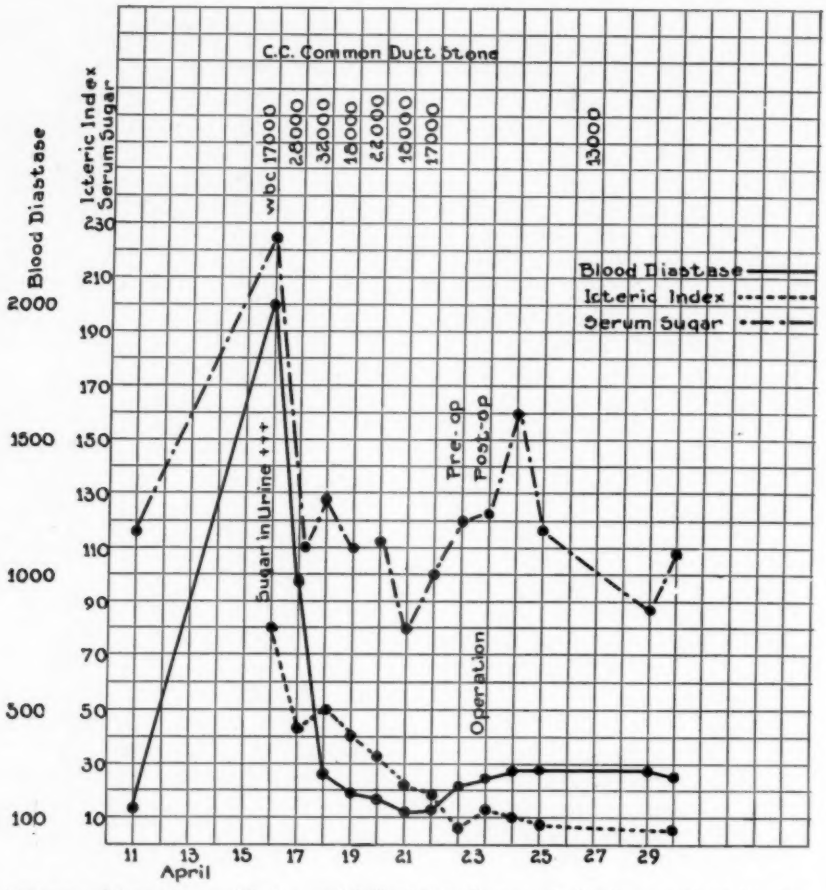

CHART 1. Note the rapid rise and fall of the diastase index in a patient having choledocholithiasis.

hepatitis, carcinoma of the pancreas and common duct stone. In seventy-seven cases in which the patient had hepatitis the diastase did not exceed normal at any determination. In twenty-seven cases of carcinoma of the pancreas, the urinary diastase was found to be normal, while in thirty-two of fifty-six cases of stone in the common duct there was an increase in urinary diastase.

In a later paper Foged[1] found that 61 per cent of the cases of choledocholithiasis in a series of sixty-nine cases showed an increase in the diastase, and accordingly in cases of biliary colic which have an elevated diastase he advises exploration of the common duct.

tween the different types of jaundice. He found that in seventy-four cases of jaundice due to a stone in the common bile duct there was an increase in the diastase value in thirty-nine of the cases, or 53 per cent. In seventeen cases this occurred only for one to two days, while in twenty-two cases there was an increase in the diastase for three days or more. The diastase rise was only moderate in twenty of these cases, while in the other nineteen cases it was rather high. Millbourn believes that the 53 per cent is only a minimum figure and that perhaps if the patients were seen at an earlier moment the percentage of cases having an increased diastase would be higher. He also noted that the diastasuria

was usually associated with pain or attacks of pain. In his series of twenty-eight cases of jaundice associated with acute hepatitis there were only three cases of diastasuria and in these the rise was very moderate. He concluded that increased diastasuria in cases of jaundice was of value, for more than one-half of all the cases of choledocholithiasis have an increase, while in the case of jaundice due to tumor of the pancreas or to hepatitis, the percentage is very low.

Somogyi[3] found low diastase values in icteric bloods associated with hepatitis, cirrhosis, abscess of the liver, and carcinoma of the liver. From this he was led to believe that low blood diastase is found only in cases in which some form of liver damage and consequent impairment of liver function are present.

We have had several instances of low blood diastase readings in cases of acute cholecystitis. A biopsy of the liver taken at operation in one of these cases showed acute hepatitis. Similar involvement of the liver probably was present in the others.

The blood diastase index has been followed in a series of seventy-five cases of cholelithiasis in order to determine its value as an aid in the diagnosis of common duct stone. In this series of cases there were twelve common duct stones recovered at the time of operation. We have found that the elevation of the index is of value providing the samples are obtained during or immediately after an attack of biliary colic as the result of a calculus in the common duct. In six of these twelve cases of common duct stone there was a definite rise in blood diastase index, varying in amount from 300 mg. per cent to over 1000 mg. per cent. We were fortunate in seeing these cases immediately after the onset of the attack. In the remaining six cases, however, a period of four days or more had elapsed and at that time the index was found to be within normal range.

In the cases of cholelithiasis alone the index was found to be slightly elevated in ten cases. With one exception, this rise in the diastase was below 250 mg. per cent. However, in one case of cholelithiasis associated with acute cholecystitis there

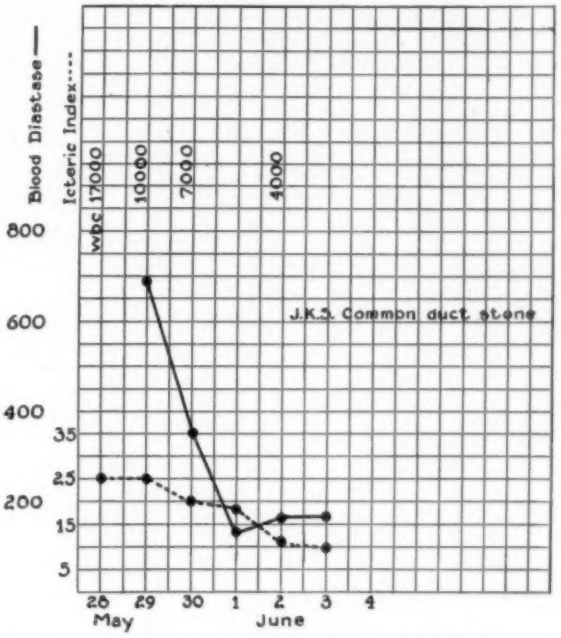

Chart 11. This shows a rapid fall in the blood diastase following the onset of pain.

was an elevation of blood diastase to 600 mg. per cent. Whether a stone was present in this case, but was not found at operation, cannot be determined. The rapidity of the fall of the diastase index following the acute attack of colic can be best shown by the following cases:

C. R. C. was first seen April 11, 1935, eight days after a typical attack of biliary colic. Blood diastase at that time was 140 mg. per cent. She reëntered the hospital April 16, 1935, complaining of severe pain in the epigastrium and right lower quadrant of sixteen hours' duration. At this time there was an icteric tint to the skin and the diastase index was found to be 2,000 mg. per cent. (Chart 1.) There was a rapid fall of diastase index with return to normal in forty-eight hours. It is interesting to note in the chart the slight rise in the diastase index following operation, which may be due to edema of the papilla following dilatation.

J. K. S., a 56 year old married woman, entered the hospital on April 28, 1935, complaining of pain of twenty-four hours' duration. This was the fourth similar attack of epigastric pain in the month previous to admission. The

present attack was characterized by sudden colicky pain in the epigastrium and was associated with involuntary vomiting. The diastase index on April 29 was 689 mg. per cent. Chart II shows the return to normal within seventy-two hours after the onset of the attack.

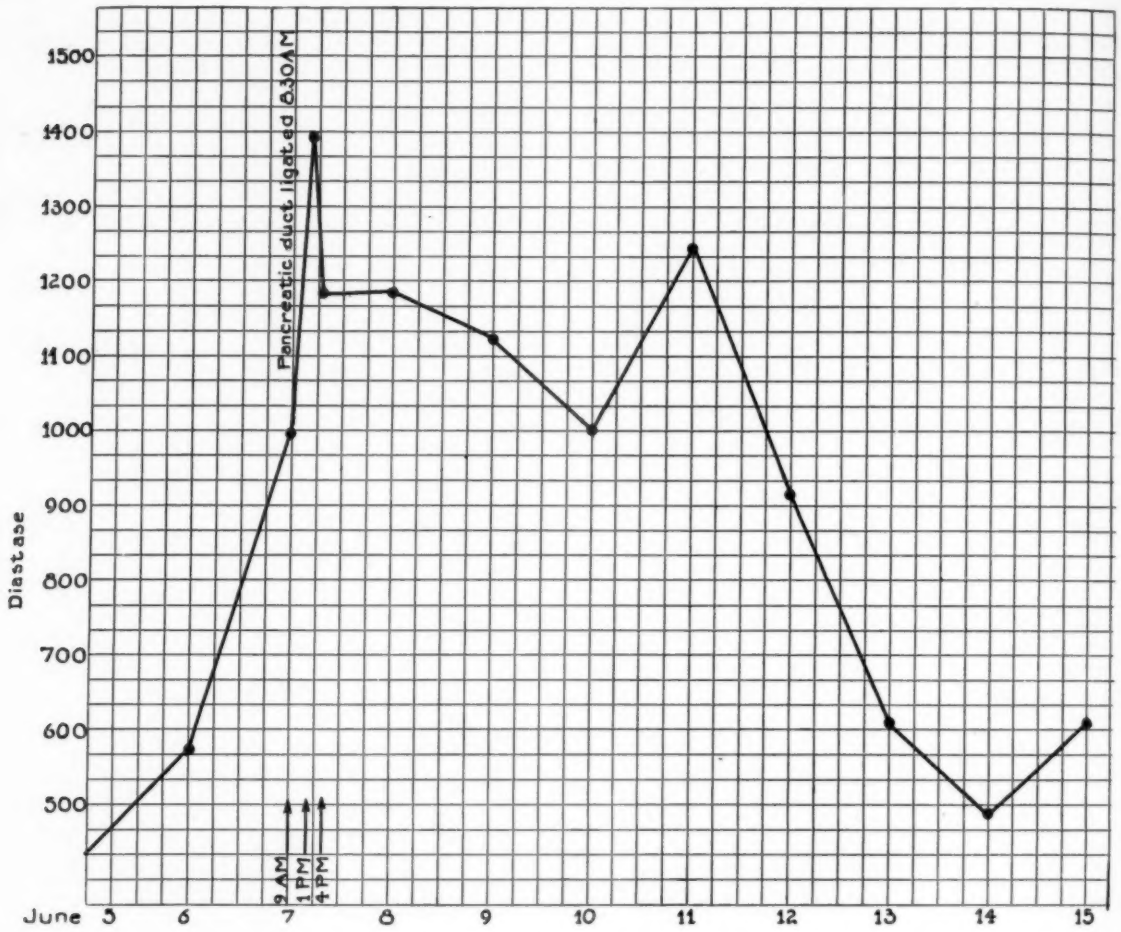

CHART III. Demonstrates the rise, persistent elevation and fall of the blood diastase in the dog, following ligation of the pancreatic duct.

The findings in these cases would make one very anxious to carry out this laboratory test in cases of suspected common duct stone if it were not for the fact of the rapid return to normal. This unfortunately prevents one from using the diastase index as an accurate aid in the diagnosis.

The rationale of this procedure can be explained by a series of laboratory experiments which have been carried out on the dog. In the dog the pancreatic ducts, of which there are two, empty separately from the common duct into the duodenum. After both of these ducts are ligated we found that there was a sharp rise in the blood diastase coming on almost immediately following the ligation. (Chart III.) This elevation remained for a period of thirty-six to seventy-two hours, and then returned to a normal level. The diastase value was also determined in these four dogs during a period of several months following ligation, and it was found that the index was within the normal range. In two animals the entire pancreas was removed. There was a rather rapid fall in the blood diastase until only a negligible amount was found. These dogs were then placed on insulin and there was a return of the blood diastase to a practically normal level with the usual response of the elevated blood sugar to insulin.

The difficulty of the use of the blood diastase index in common duct stone can be clearly seen by this experimental evidence. Therefore, the findings in our clinical cases of a normal diastase index would be expected if the blood is taken after a period of seventy-two hours has elapsed following the onset of the acute biliary colic.

CONCLUSIONS

The diastase index of the blood may be of value in the diagnosis of common duct stone providing the patient is seen during or immediately following the attack. The difficulty in determining the diastase index and the relatively small percentage of cases in which it was elevated would not indicate its routine use as an aid in cases suspected of having a common duct stone. The usual signs and symptoms, together with the findings at operation, are after all the more important factors in making this diagnosis.

Bile and bile salts, acting through their natural channel, the intestinal mucosa, have a temporary local stimulating effect on the motility of the small intestine.
From—"Bile—Its Toxicity and Relation to Disease" by O. H. Horrall (University of Chicago Press).

NON-CALCULOUS CHRONIC GALL-BLADDER DISEASE*†

MERLE J. BROWN, M.D.

Fellow in Surgery, Robert Packer Hospital

SAYRE, PENNSYLVANIA

THE unsatisfactory results in surgery on the non-calculous chronic gall-bladder are attested by the writings of leaders in this field of medicine. The aim of this paper is to emphasize the validity of this statement by summarizing the literature and to present the analytical data derived from a clinical and follow-up study of 346 uncomplicated cases of chronic non-calculous cholecystitis. It is hoped that these data may lend some influence in changing the methods of attack on this disease in an effort to improve the results. The cases used in this study were selected from a series of 2,079 operations on the biliary tract performed at the Robert Packer Hospital and Guthrie Clinic from January 10, 1910 to July 1, 1936.

PHYSIOLOGY

In man, about 500 c.c. of bile are secreted daily, although the amount varies at different hours of the day and with various conditions. Hemorrhage decreases secretion while a meat diet increases the secretion. Bile output is decreased in starvation but continues to be secreted until the moment of death. The normal gall-bladder is designed to store the excess bile secreted under various conditions; it is able to concentrate hepatic bile from four to ten times by absorption of water and certain inorganic salts. Gall-bladder bile is acid while that directly from the liver is alkaline. This concentrating function of the gall-bladder allows it to handle rather large amounts of hepatic bile; it may store a twelve to twenty-four-hour output of hepatic bile. Mann and Bollman[1] explained that this was the reason why dogs without gall-bladders became jaundiced sooner after obstruction of the common duct than dogs with normal gall-bladders.

Ivy[2] stated that an acutely inflamed gall-bladder does not concentrate bile, but it may do so if the inflammation of the mucosa is "patchy" or localized to the mucosa or serosa. According to this author, the acutely inflamed gall-bladder does not evacuate, but after the acute inflammation has subsided, the gall-bladder may again concentrate and evacuate. Fibrosis resulting renders concentration absent or slight. It has been found by Caylor and Bollman[3] that gall-bladders with hypertrophied and papillomatous rugae concentrate exceedingly well. According to Illingworth,[4] the pathologic state of cholesterosis does not affect the concentrating powers or evacuation of the gall-bladder unless associated with moderate or severe cholecystitis.

Ravdin and his associates[5] found evidence of concentration of calcium or bile salts or both in specimens of bile from chronic non-calculous cholecystitis cases.

The gall-bladder possesses some secretory activity, and its product is normally a mucoid bile. The rate of secretion is not known, but Birch and Spong[6] noted in human cases of cystic duct obstruction and gall-bladder fistula that 20 c.c. for each twenty-four hours could be collected. Likewise, the ducts were able to secrete a slightly viscid and colorless substance, particularly when obstructed. Rous and McMaster[7] found that when the common duct had been obstructed for twelve to fourteen days with a normal gall-bladder

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† From the Guthrie Clinic, Robert Packer Hospital, Sayre, Pennsylvania.

present, green fluid or a "green system" was found in the ducts. When the common duct was obstructed for twelve to fourteen days and the gall-bladder functionless or removed, a white fluid or "white system" was found. The surgeon often finds this white bile or "white system."

The gall-bladder has two types of motor activity: rhythmic tonus changes and tonic contraction of the musculature as a whole. While the force of contraction has not been measured,[2] contraction and evacuation have been directly observed. The chief stimulus causing gall-bladder contraction, is, according to Ivy, "cholecystokinin," a hormone produced at the stimulus of acids and fats acting in the upper part of the intestine. Of the foods known to be effective, egg yolk, cream and meats are the most potent stimulants.

During the first or second day following an operation on the upper abdomen, the gall-bladder may show a marked atonic distention, according to Sandblom.[8]

The ability of the gall-bladder to contract and evacuate depends on the tone of the sphincter of Oddi. In the presence of a spasm of the sphincter, the gall-bladder may not have enough expulsive pressure to overcome the spasm and permit emptying. Ivy and associates[9] have shown that a spastic sphincter in humans may cause biliary colic. When magnesium sulphate was introduced into the duodenum, the pain was relieved and black bile soon appeared.

In clinical work these facts and observations on gall-bladder functions are important because cholecystography depends upon the concentrating and evacuating powers.

CHOLECYSTOGRAPHY

The details of this important phase of gall-bladder diagnosis cannot be discussed here; only a review of the principles will be attempted. Graham and Cole[10] introduced cholecystography in 1924, and the test was immediately accepted as a clinical aid in diagnosis of gall-bladder disease. In 1927, Graham[11] restated the principle upon which cholecystography was founded. "Theoretically," he said, "any substance used for cholecystography must be excreted by the liver into the bile. It must pass with the bile into the gall-bladder where it must be concentrated by absorption of water in order to give the densest shadow. It is obvious, therefore, that the densest shadows will be found in normal subjects. It is equally apparent that there may be no shadow at all, or only a faint one, if the cystic duct is occluded, if the gall-bladder is unable to concentrate its contents because of a diseased wall, or if the liver is unable to excrete the substance normally. Moreover, as bile is poured out from the gall-bladder into the common duct, it is obvious that the shadow will diminish in size and gradually disappear entirely. Since the presence of food in the duodenum is accompanied by an outpouring of bile the necessity of fasting during the period of concentration of the substance in the gall-bladder becomes evident. It is seen, therefore, that cholecystography is really a means of studying the functional activity of the gall-bladder rather than a means of indicating the exact pathological lesions present." Graham gave the correctness of cholecystographic readings as 97.28 per cent, as confirmed by operation.

Zink[12] stated that failure of dye absorption, when given orally, might account for the absence of a gall-bladder shadow. He also noted that very early "strawberry types" of gall-bladders showed a marked inhibition of the concentration phenomena and often a delayed appearance of the shadow. He reported the procedure to be 96 per cent diagnostic. Kirklin,[13] in 1933, showed an accuracy of 90 to 100 per cent for the oral method as used by him, but in 8 per cent of the total cases he found it advisable to repeat the tests before drawing final conclusions. Burden[14] felt that the cholecystogram was not a reliable diagnostic aid in early or mild cholecystitis. The history of a patient with chronic gall-

bladder disease is more diagnostic than cholecystographic findings, as shown by Palmer.[15] We can conclude, therefore, that the Graham-Cole test measures gall-bladder physiology and not the extent or the character of the pathologic lesion present. Also, the test is not to be accepted as the final diagnostic aid in chronic non-calculous cholecystitis.

REVIEW OF LITERATURE

The history of the development of surgery of the biliary tract is interesting. Records show that, in the year 1618, Fabricious Hildanus was the first to remove gallstones from a living patient. An Italian, Zambeccari, in 1630, performed the first cholecystectomy on a dog. Jean Louis Petit (1743) was the first surgeon deliberately to carry out an operation for removal of gallstones. Then, in 1882, Langenbuck performed a cholecystectomy with speedy results. Mayo-Robson has been given credit for his pioneer work in surgery of the gall-bladder.

Moynihan,[16] in 1909, called attention to the subject of chronic non-calculous cholecystitis of the so-called "strawberry type." He wrote that he had "met every grade of cholecystitis from the mildest to the very severe. The most common condition is to find the gall-bladder almost normal, retaining much of its normal blue color, and all its smoothness and suppleness. These are the cases it is most essential to recognize, for in them also the removal of the gall-bladder is the only course of treatment likely to be attended by lasting success."

However, Finney,[17] in 1913, called attention to a dilatation of the first part of the duodenum inconstantly coupled with pancreatic changes and associated with atony and thinning of the stomach and duodenal walls, occurring in patients with a neurotic taint, almost invariably giving rise to a symptom complex which could not be explained by any demonstrable lesion of the gall-bladder or adjacent organs. In trying to account for failures in gall-bladder surgery, he said, "Failure to do the proper operation at the proper time, and in the proper way was chiefly responsible for our bad results."

After studying the end results of operation of ninety-nine cases of stoneless gall-bladder disease in 1911, Stanton[18] concluded that, "operations for cholecystitis without stone have not shown better results than could probably have been secured by medical means."

Until 1918, changes and enlargement of the liver had been observed in stoneless gall-bladder disease by many writers, but it was Graham[19] who proved that hepatitis was a rather constant accompaniment of chronic cholecystitis. He emphasized its importance in diagnosis of obscure and doubtful cases of biliary tract disease. In spite of this observation, which might have been expected to aid in elimination of some of the poor results in this phase of gall-bladder surgery, Alvarez (1923) and his co-workers[20] admonished that surgeons who became enthusiastic over the results of early cholecystectomy would have to check up on their work in order to avoid the danger of removing normal gall-bladders.

In 1924, after studying 888 cases of cholecystitis, Blalock[21] concluded that his findings justified the belief that the gall-bladder should be removed in all cases in which it was diseased, regardless of the presence or absence of stones. This same year brought the introduction of the Graham-Cole test[10] which, it was then hoped, would solve the problem of poor results in non-calculous chronic cholecystitis. Since this time, roentgenologists and surgeons have found that it is unreliable as a diagnostic aid.

The question of the type of operation, cholecystectomy or cholecystostomy, seems to have been settled in favor of cholecystectomy. W. J. Mayo,[22] in 1914, stated that simple drainage would not cure the majority of patients, and cholecystectomy, now the rule, did not give perfect results as yet. Mentzer,[23] at the Mayo Clinic (1928), showed that 55.7 per cent of gall-bladder operations in 1906 were chole-

cystostomies, whereas in 1926 only 4.3 per cent were operations of this type. Other surgeons who have accepted cholecystectomy as the procedure of choice are Hitzrot,[24] Deaver,[25] Lahey,[26] Muller,[27] Connell,[28] Fowler,[29] Highsmith[30] Pfeiffer[31] and others. There are very few advocates for cholecystostomy left.

The time when a cholecystectomy should be done is not so easily settled. Muller[27] felt that in supposed cases of chronic cholecystitis with atypical symptoms, and especially where there was a normal cholecystogram or a faint shadow and poor emptying, one should hesitate to advise operation until all means had been exhausted in locating a possible lesion outside of the biliary tract, or until satisfied that the patient was not in the dyskinesia group. In other words, he pleaded for a most complete differential diagnosis. Pfeiffer[31] found that the mortality in surgery for biliary tract disease ran directly parallel to the age and the condition of the patient and the extent and severity of the pathologic involvement. He stated that the low mortality at the early ages and in the absence of high grade lesions placed a heavy responsibility upon those who temporized with active and recurring pathologic processes.

Alvarez[20] found at operation that many of the gall-bladders were thin walled and normal in appearance, but in order to relieve the patient, the organ had to be removed on the strength of the good history, suggestive physical and roentgenographic findings, the presence of large glands on the cystic duct with adhesions in this region, and perihepatitis. Deaver and Bortz[25] emphasized that early operation on patients with recent disease would produce the most satisfactory results. These ideas coincided with Lahey's[26] opinion that the gall-bladder should be removed if there were adequate symptoms unrelieved by treatment, irrespective of the normal appearance of the external walls. Connell[28] believed that, in order to reduce the percentage of unsatisfactory results, it must be noted that "surgery is a means to an end and not an end in itself." He added that if one operated upon clinical symptoms alone with the usual signs of pathology absent, there was danger of performing an unnecessary and therefore a harmful operation; on the other hand to wait might permit an intercurrent pathology in neighboring viscera which would consequently diminish the chances of a permanent cure. Young[32] believed the only justification for an operation was the establishment of a diagnosis by clinical and laboratory means. Once this diagnosis was made, the gall-bladder should be removed regardless of the amount of pathology present. From his study Mentzer[23] believed the only justification for removal of a normal appearing gall-bladder was the prominence of pain in the patients with gall-bladder distress. He felt that operation should not be performed in all cases of cholesterosis because some might remain for years without any progression in the disease process. He concluded that all patients with chronic cholecystitis should be given the benefit of medical therapy before surgery was attempted.

Highsmith[30] stated that tenderness at Murphy's point was an important sign and should be present before operation was decided upon. Mason and Blackford[33] found that one-third of the cases of chronic cholecystitis could be successfully treated along medical lines. Fowler,[29] in his study, advocated early cholecystectomy because chronic inflammation of the gall-bladder was progressive. He stated that "more or less constant pain is practically always a symptom of chronic inflammation, but chronic inflammation does not always give pain." Guthrie[34] feels that this group of gall-bladder diseases is the most treacherous to handle. He is an advocate of very careful selection of cases before operation is attempted.

Obviously, from these opinions of leading surgeons, one may conclude that the indications and the time to operate have not been settled by any definite criteria.

The diversity of opinion only makes for increased uncertainty in this phase of gall-bladder surgery.

The duodenobiliary drainage, as conceived by Lyon[35] in 1919, has led to a great deal of enthusiasm in the study of this subject. Lyon developed his technique in this procedure to the extent of claiming it to be of diagnostic value. The use of it has led to an endless controversy, but the controversy has led to a great deal of research and interest in this phase of gall-bladder disease. Nevertheless, Alvarez[20] and his co-workers have concluded that as a diagnostic procedure, it is not worth the time spent. At the Guthrie Clinic, its use has come to be confined entirely to its application as a medical therapeutic procedure in cases that cannot be accepted for surgery.

The subject of pathology of the gall-bladder in chronic non-calculous cholecystitis has received much study. Graham[36] and Mackey[37] have prepared a classification which appears to be much in use, including four groups of cases. 1. The first group includes minimal lesions, in which the gall-bladder walls are not greatly thickened and in which there is concentrated bile. The mucous membrane is not disturbed, but there is some infiltration of lymphocytes into the wall. 2. Chronic catarrhal cholecystitis marks the second group. There is edema of the mucous membrane, with bile contents less concentrated and some lymphocytic concentration in the outer coats. 3. The third group is one of chronic fibrous cholecystitis, having for its characteristics a degenerate mucosa and thickened fibrosed outer layers of the wall. 4. Cholesterosis, or strawberry gall-bladder, is the last division, with a predominant picture of deposits of cholesterol esters and neutral fats in the crypts of the mucous membrane.

In addition to these pathologic features, Alvarez[20] found living bacteria in the wall of 57 per cent of non-calculous gall-bladders. In respect to these findings Blalock[21] obtained positive results in 58 per cent of all cultures. Bacillus coli was predominant and bacillus typhosus ranked second in occurrence. Incidently, Blalock found that 28 per cent of the patients had a history typhoid fever, the greater percentage of them occurring in acalculous cases. Nickel and Judd[38] found 71 per cent of strawberry gall-bladder and the majority of all chronic cholecystitis cases were sterile. Deaver and Bortz[25] wrote that 3.5 per cent of patients with non-calculous gall-bladder disease have liver involvement and 1.2 per cent have pancreas involvement. Wilkie[45] showed that intramural gall-bladder lesions in cholecystitis precede the common liver changes in that disease.

Pathologists do not agree on what constitutes a normal gall-bladder. It has even been estimated that 30 to 50 per cent of the adult population over 30 years of age have chronic cholecystitis, which is the foundation for the often-heard statement that most digestive disturbances are due to chronic gall-bladder disease. However, no figures are available as to what percentage of those with supposed chronic disease show symptoms. Autopsy records confirm the fact that many patients with gall-bladder disease never have symptoms. Since these situations exist in reality, the question may be asked, "What is added to chronic gall-bladder disease to produce the symptoms?" This, however, is a question yet to be answered.

CLINICAL STUDY

This study consists of a survey of records and follow-up on 346 cases of non-calculous chronic cholecystitis. Of this number 356 were females and 90 were males. The average age for the whole group was 41.06 years. The average age for all females was 41.55 years, while that of the married females was 43.53 years, and of the single females was 34.77 years. There were 218 married females and 38 single females. It will be noted that the average age of the married group of females was almost ten years greater than of the single group. The average age of male patients was 39.66

years. Comparatively, the males tended to be slightly younger than the females at the time they came to operation. The ratio of female to male was 2.84 to 1. (Table I.)

TABLE I
AGE GROUPING

Sex	Age Not Given	10–20 Yrs.	20–30 Yrs.	30–40 Yrs.	40–50 Yrs.	50–60 Yrs.	60–70 Yrs.	70–80 Yrs.	Total
Women	1	3	31	87	64	56	13	1	256
Men	1	0	21	26	21	15	5	1	90

It will be noted that 39.9 per cent of the women and 28.8 per cent of the men fell into the 30–40 year age group—the incidence of disease was greatest for both males and females in this decade of life. Two hundred and thirty-eight females (93 per cent) and 83 males, or 92 per cent, were between the ages of 20 and 60. In totals, 321 cases or 92.7 per cent, were operated in this period of their lives. The oldest patient was 76 years of age and the youngest 14.

The complaints of the patients were somewhat varied. The occurrence of the symptoms is given in Table II. The most commonly given symptoms are included in this list while the less common symptoms will be mentioned in narration.

TABLE II
OCCURRENCE OF SYMPTOMS

Symptoms	Occurrence	Per Cent of Cases
No record of symptoms	20	5.8
Pain in epigastrium	152	46.6
Pain in right upper abdomen	117	35.9
Nausea	143	43.8
Vomiting	126	38.6
Fulness or distress after food	63	19.3
Constipation	145	44.4
Flatulence	139	40.0
Belching	78	20.0
Indigestion	42	12.8
Pain in back or right shoulder	76	23.0
Pain in right lower quadrant	26	8.0
Loss of weight	25	7.6
Relief by soda	23	7.0
Relief by food	19	5.8
Loss of appetite	22	6.7
Jaundice	14	4.3

Percentages calculated on the basis of 326 available histories. Patients complaining of pain in the upper abdomen comprised 82.5 per cent. Nausea, vomiting, constipation, flatulence and pain in the shoulder and back were other common symptoms. The patients giving a history of relief by soda and food were suspected of having peptic ulcers, but none were demonstrable at operation.

Of the patients complaining of pain, only eight gave a history of pain of colicky character. Some gave a history of weight loss, but this was explained in most instances by the vomiting or by the fear of eating and arousing further severe distress. It was found that only 123 patients had tenderness in the right upper abdomen upon palpation; twenty-seven had the tenderness in the epigastric region. There were eight patients with tenderness in the right lower quadrant and two with the tenderness in the left lower abdomen. One complained of tenderness over the cecum while two claimed tenderness about the umbilicus, and two tenderness over the right kidney. By comparison, it is apparent that the physical findings do not coincide always with the symptomatology of the patients.

The duration of symptoms before patients came to the clinic for study and treatment was recorded. There were 174 patients who had had their symptoms for over one year; the average time for this group was 6.6 years. Forty-five had had their symptoms for less than one year, with an average time of 3.9 months. Fourteen had had symptoms for 2.5 weeks prior to admission to the hospital, while three patients gave the duration of symptoms as less than one week, averaging 3.3 days. There were twenty-seven patients who were less definite about the length of time of their illness; twenty-two gave the time as years, four as months, while one stated that the symptoms had been present for her lifetime.

It is evident from these findings that patients with a symptom complex which

may be interpreted as gall-bladder disease tend to procrastinate in seeking medical care. Perhaps this relieves the doctors of some of the blame for the large percentage of unsatisfactory results which reputedly exist in this branch of surgery. It has been stated by a number of authorities that the results depend somewhat on the length of time the symptoms of the patient have been in existence; prolonged duration of symptoms and disease tends to lead to irreparable damage to the liver and pancreas.

Laboratory work, except for the urine examinations, on patients with apparent gall-bladder disease is also summarized. There were fifty-six patients who had Wassermann tests done; of these, fifty-five were negative and one male reacted 3 plus. Of the 148 patients having the Kahn test performed, 147 were negative while one female gave a 4 plus reaction. These two patients were given antiluetic treatment. In seventy-three patients a Rehfuss test was performed. There were sixty-five with normal stomach acids; two had high hydrochloric and total acids (HCl of 110-104); two had low hydrochloric acid (10-10) and four of the group showed an absence of hydrochloric acid. These figures do not bear out those found in the literature, as some authors have found that as high as 23 per cent of these patients have an achlorhydria.

The blood work, in the main, consisted of white blood cell counts and differential counts. Of the total 346 patients, there were 230 who had 240 counts. The average white blood cell count was found to be 8,170, with an average differential of 68 per cent polymorphonuclear leucocytes and 32 per cent (by subtraction) lymphocytes. The highest count was 31,300 with a differential of 96 per cent polys and 4 per cent lymphocytes. The lowest count was 4,000 (of which there were several), with differential of 66 per cent polys and 34 per cent lymphocytes. There was no record on 116 cases. It is evident from these figures that the blood counts do not offer much of diagnostic value in these cases.

OPERATIVE AND IMMEDIATE POSTOPERATIVE STUDIES

Of the 346 patients included in this series, there were 320 upon whom a cholecystectomy was performed; nine also had a choledochotomy. The remaining twenty-six patients had cholecystostomies. An appendectomy was a secondary procedure in 186 cases.

The pathologic diagnosis of appendices included four cases of acute appendicitis; nine subacute; 109 chronic; and fifty-nine described as normal. Eighteen of the infected specimens contained fecaliths. The operative findings in relation to the appendix showed thirty with marked adhesions, four with a Lane's kink, and fifteen described as retrocecal. From these findings, one cannot but suspect that the appendix was responsible for some of the symptoms, although Mackey[37] was not able to show that the removal of diseased appendices played any part in the end results of surgery of the gall-bladder disease.

Other secondary operations performed at the time of the primary operation were: one jejunostomy, three ventral hernia repairs, four inguinal hernia repairs, one repair of epigastric hernia, one umbilical hernia repair, one pylorosphincterectomy for hypertrophic pyloric sphincter, one oöphorectomy and one salpingo-oöphorectomy.

TABLE III
PERICHOLECYSTIC DISEASE

Operative Findings	Number of Patients	Percentage of Total
Pericholecystic adhesions	199	57.5
Hepatitis	60	17.3
Pancreatitis	24	6.9
Cirrhosis of liver	4	1.1
Enlarged glands of biliary tract	63	18.2
Infected or dilated common duct	10	2.9

The operative findings outside the gall-bladder and its ducts are listed in Table III.

The 57.5 per cent of pericholecystic adhesions is less than is commonly quoted in the literature, as high as 75 per cent having been reported by some authors. Although hepatitis has been shown to be a constant companion of gall-bladder disease, only 17.3 per cent of the series were described as having it. Pancreatitis and cirrhosis of the liver were less frequent in this series than had been expected from a reading of the literature. It is rather surprising to find that only 18.2 per cent of these cases were described as having glands along the biliary tract. Other findings in the abdomen not included in Table III are: pregnancy, two; hypertrophic pyloric sphincter, one; pylorospasm, one; retroversion of uterus, two; hydronephrosis one; gastroptosis, one; dilatation of stomach, one; fibroid of uterus, two; healed duodenal ulcer, one and sliding hernia, one. These extra-biliary findings could undoubtedly account for some of the symptoms.

Mackey[37] reported a mortality of 3 per cent in 264 stoneless cases. The mortality in the present series of 346 cases was 2.6 per cent; all nine deaths occurred in the cholecystectomy group. When the mortality is calculated on the basis of 320 cholecystectomies, the rate becomes 2.8 per cent. The age of the patient and the cause of death are listed as follows:

Mrs. J. M., 61, intestinal obstruction.
Mrs. A. E., 54, cardiac death.
Mrs. C. W., 65, pulmonary embolism.
Mr. J. S., 40, following jejunostomy for ileus, seven days postoperative.
Mr. F. S., 51, lobar pneumonia.
Mr. F. D., 50, chronic myocarditis.
Mrs. P. H., 32, pulmonary embolism—seven days postoperative.
Mrs. F. C., 54, cardiac disease—one day postoperative.
Mrs. S. S., 49, cholangitis and gastric mesenteric ileus, 7 days postoperative.

There were no deaths from peritonitis. It would seem that none of these deaths could have been prevented. Some writers in the literature have given peritonitis as one of the common causes of death in operative gall-bladder cases.

CLASSIFICATION OF GALL-BLADDER DISEASE USED IN THIS ANALYSIS

The classification of the gall-bladder disease was made from the gross description of specimen since no record of microscopic study was recorded.

The first group was the slightly pathologic to normal gall-bladder. In this group, the gall-bladder wall was described to be of normal thickness, the suppleness and color of the organ were retained, and the mucous membrane was intact and normal in appearance.

The second group was identified by the term chronic cholecystitis and the gross description included slight to moderate thickening of the wall, the color varied from gray to white depending on the amount of scarring, and the mucous membrane was thickened and edematous.

The last group was designated as cholesterosis. The color of the organ was practically normal; the thickness of the wall was little changed, and the mucous membrane was reddened and contained placques or crystals, visible to the eye, of cholesterol deposits. There were no specimen descriptions of the chronic fibrous group.

RELATION OF ROENTGENOGRAPHIC AND PATHOLOGIC FINDINGS

In this series, there were 166 cholecystographic tests on 166 patients, 105 done by the intravenous method and 61 by accepted oral methods. The interpretations of the cholecystographic findings were used for study. "Normal function" indicates the filling and emptying of the gall-bladder in physiologic manner. "Delayed function" means that filling may or may not have been prompt while emptying was always delayed, and visualization was good. In the "faint shadow" group the concentration of dye was so slight that visualization was unsatisfactory and in the "no shadow" group there was no concentration of dye. (Table IV.)

TABLE IV
RELATION OF ROENTGENOGRAPHIC TO PATHOLOGIC FINDINGS

Cholecystographic Response	Pathology Slight to Normal	Chronic Cholecystitis	Cholesterosis (Strawberry)	Total No. of Readings	Per Cent of Total
Normal function...	2	18	12	32	19.2
Delayed function...	21	44	19	84	50.6
Faint shadow.....	3	10	3	16	9.6
No shadow.....	2	22	10	34	21.0
Totals.....	28	94	44	166	100.4

These findings would appear to be significant in that a delayed function was the commonest roentgenographic finding for all the classes of diseased gall bladders. Practically all of these readings occurred in the group which is the most pathologic of the three classes of lesions. Even though there were eighteen normal readings in this most pathologic group, almost twice as many others gave no shadow or an unsatisfactory faint shadow. It has been stated that the strawberry gall-bladder is able to concentrate dye sufficient for visualization; this is borne out by thirty-one out of forty-four readings satisfactory for visualization. Also, it will be seen that twenty-three out of twenty-eight readings in the slightly pathologic to normal group gave good visualization. It would seem fair, from this correlation of data, to conclude that a reading of "normal function" should mean a non-operative gall-bladder, while readings of "delayed function," "faint shadow" (unsatisfactory visualization), and "no shadow" should indicate a pathologic gall-bladder amenable to surgery.

RELATION OF ROENTGENOGRAPHIC FINDINGS TO PERICHOLECYSTIC DISEASE

It would seem likely that the presence of disease about the gall-bladder as represented by adhesions and in adjacent organs would have some significant effect on the gall-bladder function. That the liver must be able to excrete the dye is definitely known. Adhesions about the gall-bladder could prevent emptying of the organ by obstructing or binding the organ to the extent of neutralizing its contractile powers required for evacuation. Also the presence of adhesions might represent a more advanced stage of the disease—the inflammatory reaction having gotten beyond the confines of the gall-bladder. Directly, it is not likely that pancreatic involvement would effect the concentrating capacity of the gall-bladder, but it also represents a progression of the disease outside the biliary tract. With these possibilities in mind, Table v has been prepared.

TABLE V
RELATION OF ROENTGENOGRAPHIC FINDINGS TO PERICHOLECYSTIC DISEASE

Cholecystogram Reading	Adhesions	Hepatitis	Pancreatitis	Cirrhosis	No Pericholecystic Disease
Normal function....	18	6	4	0	10
Delayed function....	55	22	5	0	16
Faint shadow.....	11	3	1	1	3
No shadow.....	15	3	4	2	16
Total.....	99	34	14	3	45

The case with the involvement of the adjacent tissues and organs gave a small percentage of normal cholecystographic readings. The "delayed function" interpretation was highest in all groups except in the three cases of cirrhosis in which the shadow was unsatisfactory or absent. Over one-half of the cases with adhesions gave a "delayed function." This would seem significant in indicating more advanced pathology. In the hepatitis group there were twenty-two out of thirty-five cases showing delayed reactions. The distribution of findings in the pancreatitis group was so even that no deductions were possible. In the group with no pericholecystic disease the spread of roentgenographic findings was so uniform that no conclusions could be made. In this group of cases, the amount of pathology in the gall-bladder was wholly responsible for the radiographic response.

FOLLOW-UP RESULTS AND STUDIES

At the beginning of this follow-up study there were 346 patients. The earliest cases were operated on beginning January 1, 1921. The latest patients were included to July 1936, giving a follow-up period of at least six months from the date of operation. There were seven cases followed less than one year, but all others were seen for one to fifteen years postoperatively. Most of the follow-up results were obtained by mail, while a few were questioned and examined at the Guthrie Clinic.

The letters sent to all patients were made as simple as possible. A statement of our purpose in seeking replies was made in the introductory paragraph and three easily understandable questions were included in the letter. The questions were:

1. Have you had permanent relief of your symptoms?
2. If not, describe the symptoms you have had.
3. When did these symptoms recur following the operation?

Question 2 leaves the patients to their own resources in describing or enumerating their symptoms. Instinctively, the patients describe the symptoms that are most annoying to them, and in our experience, most of them were capable of explaining the exact feelings. The third question was designed to bring out whether the symptoms continued from the time of operation or recurred some months or years later. The replies were analyzed as critically and as fairly as possible.

Of the 346 cases there were twenty-six cholecystostomies, and the remaining 320 were all cholecystectomies. Of the 320 cases of cholecystectomy only nine had choledochotomies. The cholecystostomy group will be dismissed by simply giving the follow-up results without further analysis, as shown in Table VI.

Permanent relief means a positive cure, i.e., the patients complain of no symptoms. The improved Grade I group is composed of those patients with no pain but having some occasional mild indigestion of the same type as complained of before operation. Grade II improvement includes those patients who complain of some mild epigastric or right upper quadrant distress and some digestive symptoms all of which are less severe than before operation. The no relief group are those patients whose symptoms have not been changed by the operation or were made worse. "No return" means that the patients neglected or refused to answer, and includes also those who could not be located.

Table VI

Degree of Relief of Symptoms	No. of Cases	Per Cent of Total
Permanent relief	9	34.6
Improved (Grade I)	3	11.5
Improved (Grade II)	4	15.3
No relief	6	23.0
No return	4	15.3
	26	99.7

Less than 50 per cent of the total number were cured by cholecystostomy, but the total of cured and improved combined was 61.4 per cent. Although this series of cholecystostomies is small, it bears out the commonly accepted opinion that this procedure is unsatisfactory in non-calculous chronic gall-bladder disease.

The follow-up results for the 320 cases of cholecystectomy are listed below in a manner similar to that for cholecystostomy. (Table VII.) There were 275 patients who answered our letters, and this number has been used in calculating percentages.

Table VII shows that 70.8 per cent of the 275 cases accounted for were cured or improved. The 25 per cent of patients with no relief coincides with the results of studies of a number of other authors. The two deaths listed separately are patients whose relatives answered the queries but simply stated that the patients had died several years after operation without giv-

ing any statement as to cause of death or the symptoms before death. The immediate postoperative deaths were 3.6 per cent of the total number of patients accounted for.

TABLE VII

Degree of Relief after Cholecystectomy	No. of Patients	Per Cent of Total
Permanent relief	109	39.6
Improved Grade I	48	17.3
Improved Grade II	38	13.8
No relief	69	25.0
Deaths—pre-mortem condition unknown	2	0.7
Postoperative deaths	9	3.6
	275	100.0

The true death rate has been previously discussed. The total replies on all cases represented 82.9 per cent.

RELATION OF FOLLOW-UP RESULTS AND DEGREE OF PATHOLOGY

The degree of advancement of the pathologic lesion of the gall-bladder has been accepted as a factor in determining the amount of relief obtained. In other words, the more advanced the pathology of the gall-bladder, the greater should be the percentage of relief. The results as allocated in Table VIII seem to indicate the veracity of this assumption.

TABLE VIII

RELATION OF END RESULTS TO DEGREE OF PATHOLOGY

Degree of Improvement	Slightly Pathologic to Normal	Chronic Cholecystitis	Cholesterosis	Total
Permanent relief	16	61	32	109
Improved (Grade I)	9	28	11	48
Improved (Grade II)	8	18	12	38
No relief	13	41	15	69
Total	46	148	70	264

There were 264 patients whose degree of relief of symptoms was used in this survey. The greater number of patients fell in the "chronic cholecystitis" group pathologically, which represents the most advanced lesion grossly. There were sixty-one cures (55 per cent) in this group. However, there were more than double the number of cases of no relief in this group as in the cholesterosis group and slightly-pathologic-to-normal group. The total of complete and partial relief in patients with definite chronic cholecystitis was 107, or 40.5 per cent. There were thirteen cases of no relief in the slightly-pathologic-to-normal group, while the number of cures was only sixteen. It is surprising that there were nearly 30 per cent of cures in the cholesterosis group. It is evident that surgery does its greatest good in the more advanced gall-bladder disease.

RELATION OF PERICHOLECYSTIC DISEASE TO END RESULTS OF CHOLECYSTECTOMY

In going over the case records, many cases, at operation, were described as having adhesions, pancreatitis, hepatitis, cirrhosis or glands along the ducts of the biliary tract. The frequency of these raised the question as to what influence these findings could have on the end results. Table IX is a composite of the correlation. Some cases had more than one of these pericholecystic involvements, but are credited in the column of each.

TABLE IX

RELATION OF PERICHOLECYSTIC DISEASE TO END RESULTS IN CHOLECYSTECTOMY

Degree of Relief	Adhesions	Hepatitis	Pancreatitis	Cirrhosis	Enlarged Glands
Permanent relief	74	18	11	1	24
Improved (Grade I)	29	9	6	0	12
Improved (Grade II)	21	11	4	1	7
No relief	40	9	0	2	10
Total	164	47	21	4	53

Seventy-four of the patients, or 45 per cent, who had adhesions and gave follow-up results, were permanently cured by the operation. The cured and improved in this group amounted to 124 out of 164, or 75 per cent. Of those with hepatitis eighteen, or 38 per cent, were cured, while the cured and improved combined

amounted to 80 per cent of the forty-seven cases. Of those having pancreatitis, about 50 per cent were cured, but all were either cured or improved by the operation. The scarcity of patients with cirrhosis made the analysis of this group unimportant. The largest number of those patients described as having enlarged glands along the biliary ducts were cured; forty-three out of fifty-three patients were either cured or improved. These figures would indicate that the best results can be expected from surgery when the disease is advanced beyond the gall-bladder walls.

RELATION OF END RESULTS OF SURGERY TO ROENTGENOGRAPHIC FINDINGS

There were 155 patients who had the Graham-Cole test and replied to the questionnaire. The correlation of the results with the roentgenographic interpretation is included in Table x.

Table x
RELATION OF END-RESULTS OF SURGERY TO RADIOGRAPHIC FINDINGS

Degree of Relief	Normal Function	Delayed Function	Faint Shadow	No Shadow
Permanent relief	15	24	6	13
Improved (Grade I)	3	16	3	2
Improved (Grade II)	7	10	2	6
No relief	7	19	3	10
Total	32	69	14	31

The spread of cases in the various groups was rather uniform, but the greatest number of patients fell in the delayed function group. Of the sixty-nine cases in this group, fifty of them were improved or cured—approximately 72 per cent. This would indicate that the patients showing a delayed function roentgenologically gave the best results in surgery. Since delayed function might indicate a more advanced pathologic process, this finding coincided with the greater number of cures and improvements in patients with adhesions, hepatitis and other extra-biliary disease involvement.

RELATION OF END-RESULTS TO SYMPTOMATOLOGY IN CHOLECYSTECTOMY PATIENTS

There were 218 cases in which cholecystectomy was done. This group included only those cases in which an adequate history was recorded and those who answered the follow-up queries. (Table xi.)

Table xi
RELATION OF END RESULTS TO SYMPTOMS

Symptoms	Permanent Relief	Improved (Grade I)	Improved (Grade II)	No Relief	No. Cured or Improved	Per Cent Cured or Improved
Upper abdominal pain or distress	92	40	28	58	160	73
Nausea	39	16	12	30	57	58
Vomiting	35	11	8	29	54	65
Constipation	40	18	14	27	72	72
Flatulence	43	18	15	29	76	72
Pain in shoulder or back	16	10	4	22	30	58
Epigastric tenderness	47	13	12	29	72	71

There were 218 cases with upper abdominal pain or distress and of these 160, or 73 per cent, were cured. Of those complaining of nausea, 97 in all out of the group of 218, 58 per cent were cured or improved. There were 83 with vomiting with 65 per cent cured or improved; 101 had constipation and 72 (72 per cent) were permanently relieved or improved. There were 105 with flatulence, of whom 76 (72 per cent) were improved or permanently relieved. Those having pain radiating to the back and right shoulder were only 58 per cent cured or improved. From the standpoint of physical findings, the most important and commonest was tenderness in the upper abdomen either in right upper quadrant or the epigastrium; there were 99 of the 218 with this finding. Of this group, 71 per cent were cured or improved.

When it is remembered that 70.8 per cent of the whole group of cholecystectomies were cured or improved, it would appear from the similar percentages of results for individual cardinal symptoms that there is a definite relationship of

symptomatology and the end-results to be expected in any given case. In those cases with upper abdominal pain or distress, constipation, flatulence and epigastric tenderness, the surgeon has approximately a 75 per cent chance of curing or giving the patient some relief.

SUMMARY OF DEATHS SINCE OPERATION

Excluding immediate postoperative deaths, discussed in another section, there were fourteen deaths reported in the follow up survey. (Table XII.)

TABLE XII

Name	Age	State of Relief	Date Operated	Date of Death	Cause of Death
Mr. W. A.	50	No relief	1923	6-3-36	Not given
Mrs. P. B.	57	No relief	1925	1930	Abscess (?)
Mrs. T. B.	59	No relief	1923	*1923	Not given
Mr. H. C.	48	Imp. G. II	8-19-29	5-14-32	Not given
Mrs. J. F.	66	No relief	6-13-29	6-7-33	Cardiac disease
Mrs. O. H.	56	No relief	1925	1-29-30	Kidney disease
Mrs. W. H.	35	Not given	1927	6-1933	Cancer of stomach
Mr. H. H.	28	Cured	1924	1-1-34	Drowned
Mr. W. J.	76	No relief	11-2-34	4-1936	Operation for adhesions at another hosp.
Mrs. E. J.	68	Cured	1923	11-1932	Mass in left abdomen
Mrs. L. N.	38	Imp. Gr. I	1921	1-1-37	Not given
Mr. G. P.	55	Not given	10-1931	5-12-34	Not given
Mrs. A. V.	61	No relief	8-30-35	11-29-35	Not given
Mrs. F. W.	53	Imp. Gr. II	11-3-28	1932	Apoplexy

* 11 days after returning home.

In most instances death occurred a number of years after the gall-bladder operation. It is interesting to speculate on what caused the death of Mrs. T. B. eleven days after returning home. Since she was 59 years old, it would seem that apoplexy or pulmonary embolism would be most likely to cause such a rapid termination. There appeared to be no cases in which the death could be attributed to the gall-bladder operation.

RESULTS FROM LITERATURE COMPARED WITH THOSE OBTAINED IN THIS STUDY

Since the results of surgery in stoneless gall-bladder disease form an important part of this thesis, it is essential to compare the results of this study with those of other authors. An attempt has been made to summarize these results in tabular form so that the readers may gain at a glance the unsolved problem of gall-bladder disease. In Table XIII the results are summarized, covering a period of twenty-five years. The number after the author's name is the bibliographic guide to the source of the results.

It is of interest to compare the findings of Stanton in 1911 and 1932. Most of the operations were cholecystostomies in 1911, and there were 46 per cent cures; in 1932, cholecystectomy predominated and the final analysis showed 53 per cent cures. Thus, with a supposedly better knowledge of gall-bladder disease, its diagnosis and improved technique in surgery, there was a gain of only 7 per cent in cures. However, Stanton's results in 1932 were calculated on a time basis; when he calculated results in the usual way, he found that sixty-seven out of ninety cases, or 74.5 per cent, made complete recoveries. Listed under "per cent cured" in Table XIII, the figures of Alvarez included the cases which were cured or improved. The cases of Deaver and Bortz included both acute and chronic stoneless gall-bladder. Their figures for cures would not be so high if only the chronic cases were considered. Out of

Young's 115 cases there were fifteen with stones, which accounted for the increased cures in his series. The figures of Judd and Priestley were averaged to obtain those in the table. They had fifty cases upon findings of Alvarez, Mackey, Graham and Mackey, Stanton, Mason and Blackford, Highsmith and Hitzrot and Connell appeared to be from the most critical analyses, hence they are probably the most

TABLE XIII

COMPARISON OF RESULTS IN NON-CALCULOUS CHRONIC CHOLECYSTITIS

Author	Date	No. of Cases	Cholecystectomy	Cholecystostomy	Per Cent Cured	Per Cent Improved	Per Cent No Relief	Per Cent Mortality	Remarks
Stanton[18]	1911	99	7	92	46.0	33.0	19.0		
Alvarez et al.[20]	1923	60	?	?	77.0	....	....	1.7	This per cent cured includes those improved.
Hitzrot & Cornell[24]	1926	...	...	..	41.0	....	9.9		
Deaver & Bortz[25]	1927	438	429	9	65.5	17.5	8.25	2.91	Includes acute and chronic non-calculous cases.
Muller[41]	1927	42	37	5	76.2				
Olch[40]	1927	...	...	..	100.0				
Young[32]	1928	115	...	..	63.0	22.0	15.0	1.3	Total cases included 34 with stone.
Connell[28]	1928	30	8	22	76.1	....	23.8	.....	Results are averages.
Highsmith[30]	1931	100	...	..	46.0	25.0	11.0	1.0	
Judd & Priestley[42]	1932	72	21	51	73.8	....	20.1	.....	Results are averages.
Stanton[43]	1932	67	41	7	53.0	....	47.0	.....	Calculated on time basis.
Ross[44]	1932	...	...	..	60.0	....	.....	2.6	
Mason & Blackford[33]	1932	...	...	..	56.0	27.0	17.0		
Mackey[37]	1934	264	264	..	30.0	30.0	37.0	3.0	
Graham & Mackey[36]	1934	161	161	..	31.7	33.5	34.8	.4–1.0	
Pfeiffer[31]	1936	43	43	..	72.0	....	.....	0	
Shafer[39]	1936	98	98	..	74.0	....	26.0	.....	74 per cent includes cured and improved.
					34.6	26.8	23.0	0	Cholecystostomies.
Results of this study	1937	346	320	26	39.6	31.1	25.0	2.8	Cholecystectomies.

whom cholecystostomy was done, giving 62.9 per cent satisfactory results and 26 per cent unsatisfactory results; 12 per cent of these had to have reoperation. One case of cholecystostomy had also a choledochostomy. There were twenty-one upon whom cholecystectomy was performed, with 85.7 per cent satisfactory and 14 per cent unsatisfactory results. The figures of Shafer, which are listed in the table as cured, represent those cases cured or improved. The results of Connell were averages for cholecystectomy and cholecystostomy. The standard. The results of this present study compare favorably with the findings of these men.

It is evident that cholecystectomy has been the choice among operative procedures. The mortality for the operations ranges from 1 to 6 per cent. When the results are examined closely from the earliest to the most recent, it is evident that there has not been a phenomenal improvement in the percentage of good results.

DISCUSSION

Many of the patients with unsatisfactory results have been reëxamined at this clinic since operation. Four of this group have now been diagnosed as victims of some type of neurosis. Two have been given diagnoses of biliary dyskinesia, and in one of these there is a definite achlorhydria. One patient has a pylorospasm, while another has been shown to have a hydronephrosis with symptoms simulating a Dietl's crisis. One patient had a jejunostomy for marginal ulcer three years after the cholecystectomy and had had a posterior gastroenterostomy for an ulcer six years before the cholecystectomy. One patient who claimed no relief has now, six years postoperatively, definite anginal attacks. There are four cases who have been found to have an intercostal neuralgia. Two of these patients have been examined in other clinics and are suspected of having peptic ulcer. One patient has hypertension and another has ptosis of the stomach. When the character of later diagnoses is noted, the question comes to mind of how many conditions existed before the gall-bladder operation and were too early and not clear cut enough to make a definite diagnosis. At any rate, these failures should stimulate interest in the most complete differential diagnosis possible for all suspected gall-bladder cases. As suggested by Alvarez, the surgeon should check up on his results in order to gain this interest.

Mason and Blackford[33] were successfully able to treat medically one-third of their cases, and they showed that surgery in those cases which did not respond to medical therapy gave the best results. Therefore, it is suggested that a complete study be made of every patient, and that trial of a rigid medical program for a period of a few months to a year be instituted; also that a closer and longer follow-up and supervision of postoperative care might do much to lessen the disappointments in this branch of gall-bladder surgery.

As to when the gall-bladder should be removed, there are those who argue that delay in surgery lessens the chances of cure by virtue of the fact that the inflammatory disease tends to spread to adjacent organs. Let it be granted that such a tendency exists. However, from this present study, it has been shown that the majority of patients had their symptoms for over six years, and some were present for fifteen to twenty years or longer. The question, then, arises as to how much more damage would be done by a few months of medical therapy, during which time the patient could be relieved or proven to be a definite surgical problem. To this problem of surgery, Lord Moynihan's statement that the "progress in surgery is marked by the fewer number of operations performed" aptly applies.

SUMMARY

The data for this study were derived from 346 uncomplicated cases of non-calculous chronic cholecystitis.

The physiology of the gall-bladder in its modern conception and the principles of cholecystography have been reviewed.

Surgery of the gall-bladder began as early as 1618, when Fabricius Hildanus removed gallstones from a living patient.

In 1909, Moynihan called attention to the type of gall-bladder disease now known as the strawberry gall-bladder.

Stanton, in 1911, made a study of the results in stoneless gall-bladder disease.

Cholecystectomy has been accepted as the operation of choice in this type of gall-bladder disease. The question as to when the gall-bladder should be removed is unsettled.

Latest classification of pathology in this disease has been discussed.

CONCLUSIONS OF CLINICAL STUDY

The average age for females who were operated upon was 41.55 years, while that of the males was 39.66 years. The ratio of females to males was 2.84 to 1. Most patients came to operation between the ages of 20 and 60 years.

The symptoms of upper abdominal pain, nausea, vomiting, flatulence, constipation and radiation of pain to the right shoulder or back were the commonest symptoms.

The white blood cell counts of non-calculous chronic cholecystitis cases averaged 8,170, with average differential of 68 per cent polys and 32 lymphocytes.

The commonest manifestations of disease outside the gall-bladder were pericholecystic adhesions (57.5 per cent) and hepatitis (17.3 per cent).

Mortality rate for 320 cholecystectomies was 2.8 per cent, while the rate for twenty-six cholecystostomies was zero.

Cholecystographic response of delayed function was commonest in all classes of lesions. Delayed function was the most frequent response in those cases with pericholecystic diseases.

Follow-up results in twenty-six cholecystostomy cases showed 34.6 per cent cured, 11 per cent improved (Grade 1); 15.3 per cent improved (Grade 11), and 23 per cent no relief.

Of 275 cases of cholecystectomy, there were 39.6 per cent cured; 17.3 per cent improved (Grade 1), 13.8 per cent improved (Grade 11), and 25 per cent no relief.

The largest number of cases was found in the patients with definite chronic cholecystitis and cholesterosis. The greatest number of cures and improvement was in the patients with adhesions about the gall-bladder. Roentgenographically, the greatest number of satisfactory results was in the delayed function group. From the standpoint of symptoms, those patients with upper abdominal pain or distress were 73 per cent cured or improved.

Summary of deaths after operation, not counting immediate postoperative deaths, is given.

A comparison of results of this study and those of the literature shows that progress in this branch of gall-bladder surgery has not improved to any marked degree from 1911 to date.

From this study, the conclusion is reached that patients with non-calculous chronic cholecystitis should not be subjected to surgery until a complete differential diagnosis is made and a period of rigid medical therapy is tried. A longer postoperative follow-up and supervision of care is recommended.

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DRAINAGE IN TREATMENT OF PERFORATED APPENDICITIS

F. GREGORY CONNELL, M.D.

OSHKOSH, WISCONSIN

BEFORE discussing the problem of drainage in perforated appendicitis, it might be well to consider the question: Drainage of what? There are three possible sites for drainage: (1) the peritoneal cavity; (2) the abdominal wall (after closure of the parietal peritoneum); and (3) the intestinal lumen.

The conclusions of Yates[1] in 1905, which are still valid, show some of the difficulties of satisfactory peritoneal drainage. On the other hand F. C. Herrick[2] in a recent article expresses the generally accepted point of view in asking, "What is gained by closure of the abdomen based purely upon unsubstantiated theories of peritoneal resistance, except a risk?"

Recent reports by Gamble[3] and Allen[4] emphasize the value of the open wound treatment of peritonitis, but this has not met with general acceptance.

The object of these drainages is to prevent death, which presupposes a knowledge of the cause of death. Generally speaking, it may be said that the cause of death in appendicitis is not appendicitis, but is peritonitis. And the cause of death in peritonitis is not peritonitis, but ileus. Repeated autopsies have demonstrated recovery from peritonitis and death from ileus. (Cases VII and VIII.) Clinical observation shows that distention and ileus are very important, if not the only, cause of death in peritonitis. The cause of death in ileus, while unknown, is usually attributed to "toxemia" with increased capillary permeability and failure of peripheral circulation and consequential dysfunction and finally afunction of various organs and structures.

The objective of treatment of appendicitis is therefore the prevention of death by the prevention of ileus and distention; the prevention of ileus and distention by the prevention of peritonitis; the prevention of peritonitis by the prevention of perforation; and the prevention of perforation by appendectomy *before* perforation, either prophylactic or following active disease. The results of this sequence are usually satisfactory and will not be discussed.

After perforation, however, the case should no longer be considered as appendicitis, but as peritonitis or abscess, an entirely different condition (as is peptic ulcer before and after perforation). The treatment of this complication is less satisfactory and calls for discussion and improvement, if possible.

In such cases "treatment" usually consists of: (1) closure of the leak, stopping the source and the extension of the contamination; (2) establishing a point of least resistance leading away from the peritoneal cavity, i.e., peritoneal drainage; (3) decompression of the gastrointestinal tract by proximal, duodenal syphonage and distal, enemata; and (4) a multitude of accessory measures and drugs.

Such treatments, if instituted *early* are usually satisfactory, and prognosis is good; but if *late*, they often fail to prevent ileus and death. The distinction between early and late cases is easy, but that between the not so early and the not so very late is very indefinite.

In advanced peritonitis the difficult differential diagnosis between dynamic and adynamic ileus (one often a sequel to the other) is essential to proper treatment (peristaltic stimulants are contraindicated in the former).

Because of the uncertainties concerning the progress of the disease *after* perforation has taken place, the usual treatment out-

lined above may be inadequate and unavailing and another, a third type of drainage, seems to be plainly indicated.

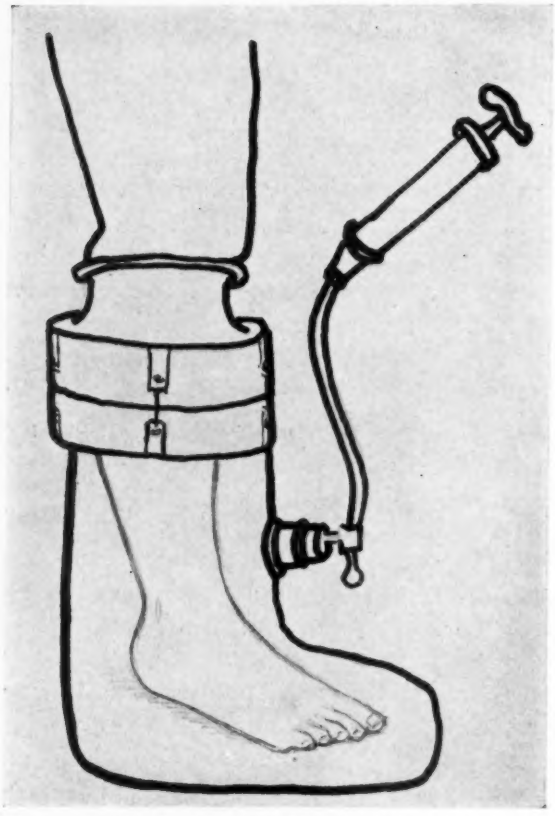

Fig. 1. Blood vessels of extremity compressed against bone and fascia. (Decompression by pulling cork.)

This consists of drainage of the intestinal lumen, enterostomy (cecostomy or ileostomy) at the time of the appendectomy, in an effort to prevent the development of distention and ileus. Such a measure will be more satisfactory as a prophylaxis, than if used as a therapeutic measure *after* ileus has developed.

It was first recommended as a prophylactic measure by Gebhart[5] in 1904, and as a therapeutic measure first advised by Henrotin[6] in 1893. A clear cut distinction between the prophylactic and therapeutic uses of this additional step in the treatment of perforative appendicitis and its resultant peritonitis, is a necessary requirement in any attempt to evaluate results.

It has been the practice of my associate, Dr. C. J. Combs, and myself, since the report of J. Wesley Long[7] in 1914 to add a prophylactic enterostomy in all cases of perforative appendicitis.

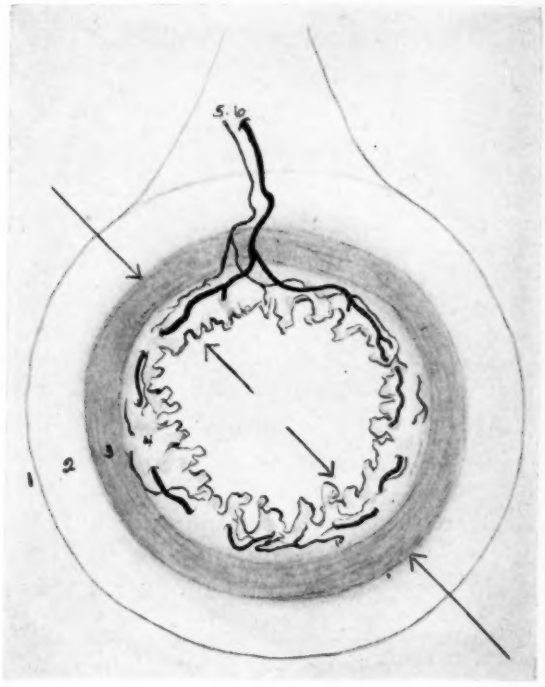

Fig. 2. Blood vessels of intestine compressed against inelastic submucosa. (Decompression by early enterostomy.) 1, serosa; 2, muscularis; 3, submucosa; 4, mucosa; 5, artery; 6, vein.

Intestinal decompression is done to prevent circulatory disturbances at the peripheral capillaries in the bowel wall, i.e., congestion, stasis, anoxemia with consequent infection from the septic lumen.

The different effects of pressure upon the somatic and splanchnic capillaries are shown in the tabulation on page 257.

In capillary stasis of the *extremities*, produced artificially, for example by compressed air apparatus, the correction is simple, i.e., by pulling the cork. (Fig. 1.) With capillary stasis of the *intestinal wall* there is no cork to pull, but by enterostomy a similar result may be achieved. (Fig. 2.)

In 1925 Dr. Walter A. Brussock, in a thesis required for graduation from Marquette University Medical School, reviewed the cases of perforated appendicitis at Mercy Hospital, Oshkosh, Wisconsin, and found eighteen cases treated

by prophylactic enterostomy with three deaths, 16.8 per cent, which was contrasted with 30 per cent death rate generally reported in the literature at that time.

	Capillaries	
	Somatic (Extremities)	Splanchnic (Intestinal)
Covered by.....	Epithelium	Mucous membrane
Environment.....	Sterile (comparatively)	Septic
Pressure.....	Atmospheric pressure unconfined	Distention constricts capillaries between mucosa and inelastic submucosa
Postural influence..	Important	Unimportant

More recent records, 1934 to 1938, show fifty-six such cases with eight deaths, 14.2 per cent. These are contrasted with eighty-eight similar cases treated without enterostomy with thirteen deaths, 14.7 per cent.

A review of the deaths after enterostomy follows.

1. Patient in extremis at time of operation; streptococcic peritonitis.

2. Pulmonary embolism twenty-six days after operation; patient about to leave the hospital.

3. Patient in extremis at time of operation, complicated by pregnancy.

4. Advanced case. Death five days after operation due to "peritonitis" and "paralytic ileus"; no autopsy.

5. Operation sixty hours after onset of attack, extensive peritonitis. Pneumonia, three weeks later empyema, rib resection. Death four weeks after operation. (No clinical evidence of peritonitis in last three weeks.)

6. Operation twenty-four hours after onset of attack. Râles in base of lung before operation. Extensive peritonitis. Death thirty-six hours after operation, due to pneumonia.

The next two cases emphasize the necessity of drainage of the terminal ileum in addition to drainage of the cecum.

7. Operation forty-eight hours after onset of attack, chill, high temperature, mesenteric thrombosis, extensive peritonitis. Pneumonia on third postoperative day. Intestinal obstruction on fifth postoperative day. Death on eleventh postoperative day. Autopsy showed no gross evidence of past or present extensive peritonitis. Ileus of terminal ileum at brim of pelvis. Cause of death ileus and pneumonia.

8. Death occurred ten days after operation, supposedly due to secondary abscess and resulting obstruction, but at autopsy there was no evidence of abscess or peritonitis, death having been due to obstruction of the terminal ileum at the brim of the pelvis (as described by Sir W. Sampson Handley[8]).

In consequence of the post-mortem findings in cases VII and VIII, I have, as a prophylactic routine, added ileostomy to the cecostomy in cases of perforative appendicitis.

These particular "statistics" are of little practical value, and scientific evaluation of results is difficult because of the small number of cases and because of a disregard of varying unknown and inconstant factors, such as the natural resistance or immunity of the individual, the type of the bacterial infection, the character (serous, seropurulent, purulent) or the extent (localized, spreading, diffuse, or general) of the peritonitis. A variety of coincidental modifying treatments also complicate the analysis.

In order to have statistics of any real value, it is important that a clear cut distinction be drawn between prophylactic and therapeutic enterostomy. The latter is usually delayed too long, and as these are the cases that have appeared in the literature, the results have been disappointing and have interfered with the acceptance of the prophylactic use of the procedure. In many of these cases the enterostomy

was probably therapeutic instead of a prophylactic measure. A distinction between cecostomy and ileostomy must also be emphasized. The work of Sir Sampson Handley shows definitely the superiority of ileostomy. (In Cases VII and VIII, had an ileostomy been established, the result would probably have been favorable.)

The procedure of prophylactic enterostomy in perforative peritonitis has a physiologic basis, it creates no additional risk, and the fear of a resultant permanent fistula has not been realized. The postoperative physical comfort would alone seem to justify its use.

A lower mortality rate could, of course, have been secured, negatively by exclusion of advanced cases, and positively, by adding a low ileostomy to the usual cecostomy.

This principle of prophylaxis against ileus, in the treatment of perforative appendicitis seems to be increasing in popularity, as may be seen from recent references.[9–18]

SUMMARY

In treatment of peritonitis drainage of the peritoneal cavity, abdominal wall, and intestinal lumen, may be carried out.

Attention is directed to the value of the third type which may prevent the establishment of ileus and a fatal outcome, if performed early after perforation.

The effect of tension upon the intestinal capillaries is contrasted with that of pressure on the somatic capillaries.

A small series of unselected cases in which enterostomy was added to appendectomy is summarized.

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GOITER IN SURGICAL PRACTICE*

FRANK GLENN, M.D.

NEW YORK CITY

THE introduction of iodine as a preoperative measure and other advances in the operative treatment of hyperthyroidism have resulted in simpler operations, fewer complications and a lower death rate. This aspect of the subject has occupied the recent literature at the expense of simple studies of goiter as it is encountered in surgical practice. A series of 100 consecutive cases of disease of the thyroid is presented to portray the relative frequency of various types of goiter with their different pathologic and clinical findings and with a discussion of treatment and results.

The cases are classified according to their pathology and clinical manifestations as toxic diffuse, toxic nodular, non-toxic nodular and non-toxic diffuse goiters. The symptoms, the clinical and pathologic pictures, the preoperative and postoperative care, the operation and the postoperative complications will be described. The detailed preoperative treatment applies more particularly to patients with hyperthyroidism, as the patient with non-toxic goiter usually requires less elaborate preliminary care. Seventy per cent of the 100 cases had evidence of hyperthyroidism.

In the group of cases, forty were toxic diffuse, thirty toxic nodular, twenty-four non-toxic nodular and six non-toxic diffuse.

The treatment in preparation for operation in disease of the thyroid may be said to consist of two elements. The first of these shall be termed the "mental preparation"; it cannot too strongly be emphasized and it should dominate every phase of the preoperative regimen. The entire hospital personnel attending the patient should contribute something to his peace of mind and his feeling of security. He is placed in a quiet single room from which all outside stimuli may be excluded and which is darkened during rest periods. Visitors are restricted and restlessness combated by mild sedatives. A study of his preferences in the matter of food makes it possible to force the patient's intake of nourishment without undue distaste or discomfort. In this the dietetic department plays an important rôle. Frequent visits from the resident staff, during which his fears and complaints receive considerate attention, serve to establish his confidence in those who are treating him. The surgeon who is to operate gains a friendly relationship with him by showing interest in his daily progress and by discussing with him the details of his treatment. The patient gradually is persuaded to accept the idea of an operation as the obvious next step toward his restoration to health and thus anticipates it without fear.

The second element in preoperative care, the "physical preparation" of the patient, must be carried out with constant observance of the principles laid down in the previous paragraph. The examinations must not be allowed to excite him, nor to interfere with his regular rest periods. The exhaustive physical examination is supplemented by *x*-rays of the chest and cervical region to ascertain whether substernal or retrotracheal goiter exists. The basal metabolic rate is determined soon after admission and once a week thereafter. This finding holds a position second in importance as compared with the clinical picture in estimating the patient's condition; but, in regard to the diet required to make the patient gain weight, it is of paramount value. The weight is recorded twice a week. If there has been a loss of note before admission, this trend should be reversed during the preoperative period. In the

* From the Department of Surgery of the New York Hospital and Cornell Medical College.

absence of edema and diabetes, a liberal supply of fluids and a high caloric, high carbohydrate diet containing sufficient protein to maintain a nitrogen balance should be given.

Medication in patients with thyroid disease is confined to mild sedatives, iodine, cathartics, and digitalis when indicated. The usual sedative is sodium amytal 0.1 Gm. three times daily, or phenobarbital or bromides may be substituted. These drugs must not be given in sufficient quantities to cause periods of confusion. Iodides are administered in the form of Lugol's solution, 0.6 c.c. three times a day. Should symptoms of iodism appear, the dose must be reduced and the condition counteracted by saline cathartics. The policy is to digitalize only those patients with signs of abnormal cardiac action, i.e., cases with auricular fibrillation or signs of decompensation. The patients with hypertensive cardiac disease and with arteriosclerosis are not included unless they manifest disturbed function. The amount of digitalis required for digitalization in hyperthyroidism is greater than in simple goiter. As a patient's symptoms decrease and as the preoperative period nears its close, less digitalis is required to produce therapeutic effects.

The preoperative regimen should be continued until the patient is in the optimum condition for operation. The selection of the time for operation depends upon a number of factors easy to recognize, but the relative importance of which it may require experience to evaluate. No dogmatic scheme can be applied to all cases. The surgeon must take into account the single case and individual reactions as well as the immediate condition. The composite picture should show a decrease in the signs of hyperthyroidism: there should be disappearance of the anxious expression and disappearance or diminution in the tense restlessness. The pulse rate should have dropped to normal or nearly to normal. Excessive perspiration should have ceased; the forced diet should have resulted in a substantial gain in weight. If this gain has been periodic with regressions, as is frequently the case, the operation should be performed in a period of gain in weight. The thyroid should be smaller than on admission. This reduction in size cannot be looked for if the patient has been on iodine treatment before admission or if he is iodine-fast. A fall in basal metabolic rate is looked upon favorably. The patient's ability to withstand the shock of operation depends largely upon the factors enumerated. One or another of the requisites for the ideal condition in which to operate may not be attainable. The surgeon must weigh the progress as a whole against the factors which have not yielded to treatment and he must not be swayed by the impatience to have the ordeal over so often evidenced by patient, the relatives and the physician.

Operation. The operation itself is that originally designed by Halsted in 1909 and more recently described by Reid and Andrus. There is little to be said about the operative technique which is not contained in these two papers. The steps in the procedure which are considered to be of major importance in the results will briefly be emphasized.

1. The patient is placed on the table in a relaxed position so that the structures of the neck are not distorted, since hyperextension actually may interfere with retraction of the ribbon muscles and, thereby decrease the lateral exposure.

2. An unsightly scar is avoided by determining the best site for the incision before the final drapes are arranged around the field of operation. This site usually is about 3 cm. above the clavicle and follows a natural fold in the skin. After the skin has been infiltrated with the anesthetic, a thread is drawn tight over the line selected for the incision. The imprint left when the thread is removed is followed by a fine scratch of the scalpel to fix the direction of the incision before the landmarks are obscured by the drapes.

3. The length of the incision must be sufficient to give satisfactory exposure. It

extends through the platysma which is dissected free from the underlying structures and, with the skin, reflected upward to a point above the thyroid cartilage and downward to the sternal notch. The fascia is divided in the midline and with the hyoid muscles is separated by blunt dissection from the subjacent sternothyroid muscles laterally as far as the neurovascular bundles and upward and downward over the poles of the gland. With retraction, the entire latero-anterior surface of the gland is now palpable under the sternothyroid muscles. The sternothyroid muscles are incised in the midline and stripped from the gland as close as possible to its surface. A few fibers of these muscles may be cut across at their upper insertion to bring the upper pole into view, for it is imperative that the superior thyroid vessels be divided between clamps under direct vision. When the vessels at the upper pole and the lateral thyroid vessels have been cut, the lobe is drawn forward and downward so as to expose its posterior surface, bringing into view any retrotracheal portion of gland which might otherwise escape detection. This maneuver also affords a view of the recurrent laryngeal nerve in many cases, and prevents inadvertent injury to it. The lower pole of the thyroid is divided within the substance of the gland to insure the preservation of sufficient blood supply to the parathyroids. When the lobe is delivered into the wound, the transection may be accomplished in one of two ways: either the gland is divided first at the isthmus and the dissection carried laterally from this point, or the gland is transected at the posterolateral border and the dissection carried medially while the lobe is still attached at the isthmus.

4. Meticulous hemostasis is maintained throughout the operation. The major vessels are transfixed with double silk ligatures. The smaller vessels are clamped as they are encountered and the clamps are left in place until the operation is halted after one lobe has been removed, while the clamped vessels are ligated with fine silk. At the end of the operation again, all clamped vessels are ligated and the wound left dry.

5. The indications for drainage of the wound are not clear-cut. If the removal of a friable gland has been attended by bleeding which it was hard to control, and a tendency to ooze persists, a drain should be used. When the transection of the gland has left a large surface of thyroid, a drain should be placed down to this surface. The drain consists of a single ribbon of gutta percha and it emerges through the midline of the wound. Only ten, or 10 per cent of the cases were drained.

6. The wound is closed layer by layer with interrupted silk sutures. The reapproximation, especially of the sternothyroid muscles, is important in preventing an ugly scar.

7. The amount of gland which it is best to leave must be determined without reference to set rules; in general, however, it is better to remove too much than too little thyroid tissue, for a slight deficiency after operation may correct itself by regeneration of glandular tissue, or may be compensated for by administration of appropriate extracts. The blood supply to the parathyroids must not be jeopardized and the recurrent laryngeal nerves must remain unmolested. In nodular goiters, except in fetal adenomata, a bilateral subtotal thyroidectomy is performed routinely.

8. At the completion of the operation, silver foil is placed over the wound before the gauze dressings are applied. The silver foil, in itself antiseptic, protects the wound from infection, for it remains in place even though the gauze dressings should shift their position.

ANALYSIS OF 100 CASES

1. *Toxic Diffuse Goiter.* In this group of forty cases there were thirty-six women and four men. The youngest patient was 16, the oldest 61 years old; the average age was 28 years.

Aside from the presence of goiter, the most common complaints were nervousness and loss of weight, the latter being noted almost without exception. Exophthalmos was evident in 82 per cent of the cases. The duration of symptoms varied between three months and eight years, the average being 1.56 years. There was evidence of cardiac disease in eleven, or 27.5 per cent of the patients, in seven of whom no cardiac pathology was noted before the onset of hyperthyroidism. In two cases the disease of the thyroid was engrafted upon arteriosclerosis, and in two others upon rheumatic disease of the heart. Auricular fibrillation was present in four patients and six showed definite signs of cardiac decompensation.

The metabolic rate was determined on admission in all cases; the lowest reading was plus 14 per cent and the highest plus 100 per cent with an average of plus 49.1 per cent. The greatest decrease in metabolic rate under preoperative treatment was 59 per cent with the average 23.4 per cent. Only two patients failed to show a lowered basal metabolic rate as a result of the preliminary treatment, and in these the readings were plus 2 and 4 per cent higher before operation than on admission.

Under the preoperative regimen described, thirty-two patients gained in weight; three retained the weight recorded on admission; and five lost less than 1 kilogram. The pulse rate was slowed between the time of admission and operation in every case; in many the fall was not uninterrupted. In these the pulse became slower, remained at the new level for a few days only to rise again, without, however, reaching the original rate. In twenty-nine cases the fall in the pulse rate was progressive.

No patient failed to show some improvement during the preoperative stages. In twenty-one cases the improvement was spectacular, an agitated and emotionally unstable person with a rapid pulse and moist flushed skin showing marked regression of these symptoms. Thirteen cases showed less marked improvement and the remaining six were practically unaffected by the preoperative regimen. The latter were the least toxic patients in the group.

The period of preliminary treatment in these patients averaged 18.7 days; in spite of this extended period of preparation, four out of the forty cases had definite, though mild, postoperative thyroid storms. The operation was performed under local anesthesia in all but one case, although general anesthesia supplemented the local in two other cases.

It should be noted that in this group of cases the average decrease in the metabolic rate was marked; after operation the rate averaged plus 8.5 per cent. All patients in this series were discharged from the hospital markedly improved.

Pathology. On *gross examination* of the toxic diffuse goiter the thyroid usually appeared symmetrically enlarged; rarely was the enlargement confined to one portion of the gland but without exception there was a demonstrable increase in its total size. If the period of iodine therapy was not long prior to operation, the thyroid was darker in color than normal and its vascularity increased. Its cut surface exuded a brown, viscid material, leaving a granular surface. If the iodine therapy had been prolonged, then the gland was lighter in color, firmer in consistency and the fluid exuded was a translucent, gelatinous material.

Microscopic examination, in patients who had taken iodine for only a short time previous to operation, showed the acini irregular and their lumen encroached upon by lining cells which were increased in number and size. In some of the acini, the epithelial overgrowth resulted in such heaping up of cells as to form papillary projections into the lumen. The acini were only partly filled with colloid of a poorly staining quality surrounded by vacuolated areas. Usually the interacinal structures showed increased vascularity with scattered areas of lymphoid hyperplasia. Under a high power lens the cells could be seen to have lost their characteristic structure.

They were different in size, shape and staining qualities. The nuclei were irregular in structure and were not placed in the center of the cell. Mitosis could occasionally be observed.

These changes were not so apparent after prolonged iodine therapy. The acini were better filled with a uniformly staining colloid surrounded by a smaller area of vacuolization. The individual cell appeared to have returned to a state bordering on the normal. The connective tissue remained prominent as well as the lymphoid hyperplasia. Characteristic of all specimens of this group were the varying degrees of transition from a state of marked hyperplasia to almost complete involution within the same portion of the gland.

2. *Toxic Nodular Goiter.* The most seriously ill patients in the entire series and, therefore, the cases which presented the gravest problems in treatment, were the thirty in the toxic nodular group. Twenty-eight of these cases were women and two men; the age varied between 20 and 66 years and averaged 48.6 years.

Loss of weight, nervousness and cardiac symptoms, such as dyspnea, and edema of the ankles, were the outstanding complaints; the duration of these symptoms averaged 6.3 years. Ten patients, or 33.3 per cent, had definite evidence of cardiac disease; only two appeared to be instances of simple disturbance of the heart associated with thyrotoxicosis. Seven cases had preëxisting arteriosclerotic cardiac disease and two had old rheumatic lesions, which, following the onset of the thyroid disease, caused signs of decompensation. In the group, eight cases gave evidence of decompensation and eight had auricular fibrillation.

The metabolic rate on admission averaged plus 36.7 per cent; the lowest reading being 14 and the highest 53 per cent. The greatest decrease in rate during preoperative treatment was 34 per cent, the average being 16 per cent. Six patients failed to respond to treatment with lowered metabolism. Seventeen patients gained weight and thirteen neither lost nor gained during the preliminary treatment. The pulse was not markedly slowed and the emotional instability resisted treatment more obstinately than in the former group of cases.

Pathology. On *gross examination*, the toxic nodular goiter showed a great variation in size, shape and consistency. The nodules varied greatly and a single gland was found to contain several types of nodules classified as follows: (a) nodules composed of normal thyroid (pseudonodules); (b) nodules composed of hyperplastic thyroid; (c) nodules composed of "colloid" thyroid; (d) "fetal adenoma" of the thyroid; (e) cysts of the thyroid; and (f) true adenoma of the thyroid.

This complex picture, characteristic of nodular goiter reveals the following on microscopic examination:

(a) Nodules composed of normal thyroid showed normal thyroid tissue compressed and distorted by pressure of surrounding structures. There was no variation from normal thyroid tissue.

(b) Nodules composed of hyperplastic thyroid tissue were the true toxic nodules, indistinguishable microscopically from the gland in toxic diffuse goiter as described under that heading; these nodules also showed the same changes of involution following iodine therapy.

(c) The nodules composed of "colloid" tissue were lighter in color than either the normal or the hyperplastic gland. They usually were small and were identical with what is later described under nontoxic diffuse goiter.

(d) The so-called fetal adenoma, on gross section showed a glazed gray surface usually encapsulated and flaked with areas of necrosis. Several small cysts containing colloid-like material were to be found. Calcification was sometimes present. On microscopic examination there was a marked absence of the normal arrangement of the acini which were small and widely separated by a peculiar structureless material resembling colloid. Scattered through this substance there could be found evidence of

hemorrhage and degeneration. Occasionally there was a dense fibrous capsule around the nodule and in the wall of this, calcium deposits.

(e) Cysts of the thyroid grossly varied in size and were thin-walled and filled with colloid-like material or a chocolate colored material flecked with crystals of cholesterol. If the cyst was of long standing, its wall would be thick with gritty calcified areas and solid cartilaginous-like projections extending into the cavity of the cyst. Microscopically, it was possible to follow the stages of cyst formation and development. It appeared that the rupture of several adjacent acini distended with colloid formed a small cyst. Subsequently, the neighboring acini ruptured into the cyst to increase its size. The process continued in this manner until the acinal vessel was injured with resulting hemorrhage within the cyst. The reaction about the hemorrhage led to fibrous thickening of the wall with hyaline degeneration and calcium deposition.

(f) There were two true adenomas of the thyroid. These are unusual and composed of strands of epithelial cells separated by a delicate stroma containing many large vessels. Under high magnification the strands were seen to be composed of solid clusters of cells in which no lumen could be detected.

Table 1 shows the comparative incidence of certain symptoms of hyperthyroidism as evidenced in the group of toxic cases. A study of this table indicates that in toxic nodular goiter the disease was more chronic than in toxic diffuse goiter. Though the manifestations of hyperthyroidism were less acute, their response to treatment was less marked. The patients were older as a group and a larger number of cases had severe cardiac damage associated with definite lesions. The improvement in terms of gain in weight and decrease in pulse rate was less striking. It may be remarked, also, that the mental manifestations of the disease were less acute but more resistant to therapy.

TABLE 1
COMPARATIVE TABLE FOR TOXIC DIFFUSE AND TOXIC NODULAR GOITERS

	Toxic Diffuse	Toxic Nodular
Total number of cases	40	30
Average age	28 years	48 years
Duration of symptoms	1.56 years	6.3 years
Preoperative gain in weight	80 per cent	56 per cent
Average B.M.R. on admission	plus 49.1 per cent	plus 36.7 per cent
Preoperative decrease in B.M.R.	plus 23.4 per cent	plus 16 per cent
Average postoperative B.M.R.	plus 8.5 per cent	plus 10.9 per cent
Presence of cardiac disease	27.5 per cent	33.3 per cent
Decompensation	45 per cent	80 per cent
Auricular fibrillation	81 per cent	80 per cent

The average period between admission and operation in the group of toxic nodular goiters was 14.6 days. It could not be hoped that an extension of preparatory treatment would lead to greater improvement.

The presence of cardiac disease was noted in 27.5 per cent of the forty cases of toxic diffuse goiter and in 33.3 per cent of the thirty cases of toxic nodular goiter. Forty-five per cent of the cases with toxic diffuse goiter and cardiac disease displayed evidence of decompensation and 81 per cent fibrillated at some time while under observation. In the ten cases of toxic nodular goiter with cardiac disease eight, or 80 per cent, showed evidence of decompensation and an equal proportion exhibited auricular fibrillation.

The gravest postoperative complications were encountered in the cases with toxic nodular goiter. In two instances it was necessary to explore the wound for postoperative hemorrhage; both patients were arteriosclerotic to a marked degree. Auricular fibrillation following operation occurred most often in this group of cases. The cyanosis, reported by some authors in connection with toxic diffuse goiter, in this series appeared to be more frequent in older patients with nodular thyroid and a low cardiac reserve.

3. *Non-toxic Nodular Goiters.* Twenty-four patients are included in this group. Few of them were ill either before or after operation. There ages ranged from 16 to 61 years, with an average of 31.2 years.

The symptoms presented by these patients varied; the majority suffered from dysphagia associated with the presence of the goiter. Cervical pain was noted in some cases and others were mainly concerned about the disfiguring effect of the tumor. A few non-toxic patients complained of symptoms commonly associated with hyperthyroidism, but it was usually apparent that these symptoms had been imposed upon the imaginative person by the anxious questions of relatives and friends acquainted with the story of hyperthyroidism. The goiter usually had persisted for about five years. The period of preoperative treatment was, in most instances, quite short and the operation was performed as soon as the routine examinations had been completed and the diagnosis made. Local anesthesia was employed in all but four of these cases; in the four cases, general anesthesia was used only because of the patient's objections to local, based on previous experience or upon unfounded prejudice.

Pathology. In *gross appearance* this goiter is indistinguishable from the toxic nodular goiter.

Microscopically, the outstanding difference between this and the toxic nodular goiter is the absence of nodules of hyperplastic tissue. There were present areas of involution and all stages of cyst formation and degenerative changes similar to those described under toxic nodular goiter.

4. *Non-Toxic Diffuse Goiters.* Non-toxic diffuse goiters formed the smallest group of cases; there were only six in the series. The complaints invariably were referable to pressure of the tumor upon the structures of the neck, as indicated by difficulty in breathing and swallowing and a feeling of constriction. All of the patients were operated upon under local anesthesia and no special preoperative preparation was deemed necessary. Like the non-toxic nodular cases, their recovery was entirely uneventful.

Pathology. Gross examination usually showed the non-toxic diffuse goiter to be the largest of all. It was lighter in color than the normal gland, was uniformly soft and its cut surface exuded a thin, watery light yellow material.

Sections of the thyroid showed the acini varying in size, but usually they were large and distended with uniformly staining colloid. The walls of the acini were thin and lined with low cuboidal or flattened epithelium.

POSTOPERATIVE TREATMENT AND MANAGEMENT OF COMPLICATIONS

The patient after operation is returned to bed in a single room and is under the constant care of a nurse, preferably one who was in attendance before operation. The special nursing is continued for twenty-four hours during which time the pulse is recorded every ten minutes, the blood pressure and rate and quality of respirations at twenty minute intervals. The patient is immediately placed in Fowler's position with the head partially immobilized by sandbags. A hypodermic injection of morphine 0.10 Gm. is given at once and followed by Lugol's solution 1.6 in 100 c.c. of water by rectum. Fluids by mouth are withheld until they can be taken without too great discomfort or difficulty in swallowing; after this the patient is encouraged to take as much fluid nourishment as possible, chiefly in the form of fruit juices for their glucose content. If, in the first twelve hours, the fluid intake has not been sufficient, fluids are given intravenously or subcutaneously. Intravenous glucose is of considerable value in the immediate postoperative therapy in toxic patients.

The wound is inspected at the end of twenty-four hours and every other skin suture is cut; the following day the cut sutures are removed and those remaining are cut.

In the routine case, other sedatives are substituted for morphine after two or three days and these are gradually reduced over a period of five or six days.

As soon as all nausea has ceased and liquid nourishment is well borne, the preoperative dose of Lugol's is given by mouth. After five or six days, the dose is cut in half and then gradually further diminished so that at the end of the hospital stay, the patient is able to get along without iodine.

The patient is allowed to sit up in bed on the seventh or eighth day and is discharged after a final basal metabolism reading on the tenth or eleventh day.

The routine described above applied to the cases which suffer no complications in the course of recovery. The three unfavorable circumstances which may occur during this period are hemorrhage, cardiac disturbances and thyroid storm. Hemorrhage usually occurs within eight hours of operation. The patient complains of constriction about the throat which may progress so as to cause respiratory difficulty and inability to talk. Associated with these complaints there is a noticeable increase in the pulse rate and fall in blood pressure. Inspection of the wound will reveal a protrusion over the operative area and, in some instances, discoloration of the skin in this region. The wound should immediately be explored, the clot evacuated and the bleeding vessel secured with ligatures.

Cardiac complications arise most frequently during the first twenty-four hours after operation. Digitalis therapy is instituted to combat this unfavorable incident.

A thyroid storm manifests itself by marked increase in pulse rate, in excitement and restlessness which fail to yield to the routine dose of morphine. There is profuse perspiration and an elevation in the blood pressure with increased pulse pressure. There may be an accompanying cyanosis which, if allowed to persist, will almost certainly lead to cardiac decompensation. A thyroid storm is combated by ample sedatives, the intravenous administration of glucose and a high caloric diet, when possible. The oxygen tent has proven of definite value in overcoming cyanosis and thereby in quieting the patient. The above measures have been satisfactorily employed in the cases in this series which developed a postoperative crisis.

Upon discharge from the hospital, all goiter patients are followed in the outpatient clinic. The first return visit is arranged for two weeks after discharge and subsequent observations are made once a month for six months. The surgeon who attended the patient in the hospital continues his friendly relationship with her and advises her as to the conduct of her life to avoid a recurrence of symptoms. If the patient's work, social surroundings or domestic responsibilities have played a part in causing the disease, a change must be made if the maximum benefit of the operation is to be maintained. Daily rest periods are prescribed to increase reserve energy. The use of iodine and sedatives may be resorted to in individual cases. It is not unusual to note a recurrence of mild symptoms of hyperthyroidism after the patient leaves the protection against worries and annoyances which the hospital has afforded.

There appear to be definite cycles in hyperthyroidism which may be noted both during preoperative and postoperative periods. The pulse diminishes, the weight increases and the nervousness subsides for varying lengths of time and then, under identical circumstances, these favorable signs may be reversed for a period, during which time it appears that the patient loses the ground she had previously gained. At the apex of the unfavorable phase of the cycle, however, she has not regressed to her original condition and each successive favorable phase brings her a little closer to normal. Iodine administered for short periods often enables the patient to escape the recurrent manifestations of hyperthyroidism.

SUMMARY

In this series of consecutive cases of disease of the thyroid gland subjected to partial thyroidectomy there may be found

what the author believes to be a fairly normal distribution of the different types of goiter. The pre- and postoperative care, the operation, the pathology and the postoperative complications have been discussed. There were no instances in the group of injury to the recurrent laryngeal nerve, nor of injury to the blood supply of the parathyroids. There were no fatalities and all patients were definitely improved on discharge from the hospital and when examined on return visits. Until a five year period has elapsed, no statement can be made concerning recurrences.

No man can ever sit down and hand out a rule of thumb method of the practice of medicine, for no work dealing with this subject in its fullest expanse can ever be dogmatic; dogma makes for a lifelessness diametrically opposed to the vivacity and variation which is medical practice.
From—"Disease and the Man" by Roger F. Lapham (Oxford).

A COMPARATIVE STUDY OF SOME ANTISEPTICS AND GERMICIDES WITH SPECIAL REFERENCE TO ALKYL-DIMETHYL-BENZYL AMMONIUM CHLORIDES*

CECIL G. DUNN, PH.D.

Instructor in Industrial Biology, Massachusetts Institute of Technology

CAMBRIDGE, MASSACHUSETTS

THERE is much that should be known about a germicide or antiseptic before it should be universally adopted. Its action against a large number of resistant micro-organisms, both pathogenic and non-pathogenic; its efficacy in the presence of organic matter; its freedom from undue toxicity; its ability to penetrate matter or reach the desired site; its action in various vehicles; its stability under adverse conditions of storage; its effectiveness under clinical conditions; its limitations; and its comparison with other germicides or antiseptics—all are highly important and desirable facts which the physician and others interested in its use may wish to know.

Considerable research has already been carried out concerning various aspects of alkyl-dimethyl-benzyl ammonium chlorides[1–6] with very promising results.

In the present study, only a few well-known agents are compared in respect to their germicidal action towards Staphylococcus aureus, Government 209, Escherichia coli and Bacillus subtilis.

EXPERIMENTAL

The antiseptics used were purchased in the open market, except for the alkyl-dimethyl-benzyl ammonium chlorides, which were obtained through the courtesy of the Alba Pharmaceutical Company. Standard Food and Drug Administration methods or modifications were used throughout the study. Since several of the germicidal substances used were known to possess high bacteriostatic potency, sub-subcultures were made wherever deemed necessary by transferring four 4-mm. loopfuls of material from each subculture tube to each sub-subculture tube. Staph. aureus was obtained from the Food and Drug Administration; B. subtilis and E. coli from the stock collection of the Department of Biology and Public Health. Reddish broth was used as the subculture medium.

Comparative Tests with Staph. Aureus and E. Coli. In Tables I and II are given

TABLE I

GERMICIDAL TESTS WITH STAPHYLOCOCCUS AUREUS, GOVERNMENT 209

Antiseptic		Average Phenol Coefficients		Average Highest Dilutions Destroying Test Organisms in 10 but Not in 5 Minutes	
		20°C.	37°C.	20°C.	37°C.
Alkyl-dimethyl-benzyl ammonium chlorides, 1:1000	1:1000 aqueous	0.33	0.42	1:20	1:35
	1:000 tincture	0.40	0.75	1:26	1:60
Hexylresorcinol (S.T. 37)		0.069	0.075	1:4.5	1:6
Tincture merthiolate 1:1000		0.025	0.031+	1:1.5	1:2.5
Tincture metaphen 1:200	fresh	.....	0.063	.....	1:5.5
	1½ yrs. stored	0.024	0.041+	1:1.75	1:3.5
Pepsodent		0.15	0.14	1:9	1:11.5
Phenol		.....	.....	*1:60	†1:83

* Average of twenty-five tests.
† Average of sixteen tests.

* Contribution No. 124 from the Department of Biology and Public Health, Massachusetts Institute of Technology. Research aided by a grant from the Alba Pharmaceutical Company.

The opinions here reached are personal and in no sense are to be regarded as official findings of the Department or of the Institute.

TABLE II
GERMICIDAL TESTS WITH E. COLI

Antiseptic	Average Phenol Coefficients		Average Highest Dilutions Destroying Test Organisms in 10 but Not in 5 Minutes	
	20°C.	37°C.	20°C.	37°C.
Alkyl-dimethyl-benzyl ammonium chlorides, 1:1000 (aqueous solution)	0.12	0.31	1:9	1:35
Hexylresorcinol (S.T. 37)	0.06	0.05	1:4.5	1:5.5
Tincture merthiolate 1:1000	0.026+	0.045	1:2	1:5
Tincture metaphen 1:200 (untinted)	0.077	0.64	1:5.5	1:70
Pepsodent	0.15	0.12	1:11	1:13
Phenol	.....	.....	*1:75	†1:112

* Average of sixteen tests.
† Average of fifteen tests.

the results of comparative tests with Staph. aureus and E. coli, using medication temperatures of 20°C. and 37°C. Each value represents the average of two to five tests, unless otherwise stated.

Figure 1 shows graphically the relationships existing between the germicidal agents in respect to the two organisms. The reciprocals of the dilutions destroying the test organisms in ten but not five minutes are given. The solidly shaded portion in each column represents the amount of the basic solution of the antiseptic or germicide used. Each cross-hatched area represents the number of parts of distilled water used with each part of chemical solution at a temperature of 20°C. The number of parts of distilled water used with each part of germicide at 37°C. is denoted by the entire area of each column minus the solidly shaded area. For example, a 1:60 dilution of phenol (column A, left) destroyed Staph. aureus in ten but not five minutes at 20°C. while a 1:83 dilution accomplished the same results at 37°C.

At both 20°C. and 37°C., alkyl-dimethyl-benzyl ammonium chlorides destroyed Staph. aureus more readily than any of the other antiseptics except phenol, the mercurials being least effective as germicides.

When Escherichia coli was used as the test organism at 20°C., the descending order of germicidal efficacy was: phenol, pepsodent, alkyl-dimethyl-benzyl ammonium chlorides, tincture metaphen (1:200),

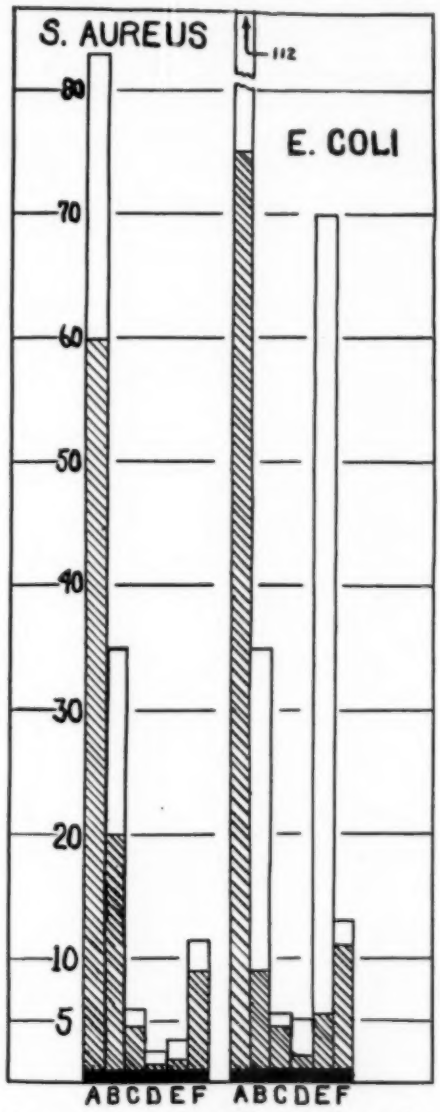

FIG. 1. Reciprocals of dilutions destroying the test organism in ten but not in five minutes. A, phenol. B, alkyl-dimethyl-benzyl-ammonium chlorides. C, hexylresorcinol. D, merthiolate. E, metaphen. F, pepsodent.

hexylresorcinol and tincture merthiolate (1:1000). At 37°C. the order of efficacy was somewhat different—phenol, tincture metaphen, alkyl-dimethyl-benzyl ammonium chlorides, pepsodent, hexylresorcinol and tincture merthiolate.

Effect of Organic Matter. In the following tests, 2.5 c.c. of normal horse blood

serum was added to 2.5 c.c. of germicide or antiseptic in a medication tube and warmed or cooled to the temperature of the test. Then 0.5 c.c. of a broth culture of Staph. aureus, Government 209, was added to each medication tube and subcultures made at definite time intervals. Sub-subcultures were always made when judged to be necessary.

TABLE III
COMPARATIVE TESTS WITH STAPHYLOCOCCUS AUREUS IN 50 PER CENT SERUM

Antiseptic	Average Survival Time in 50 Per Cent Serum (in Minutes)		pH of Antiseptic[1]
	20°C.	37°C.	
Alkyl-dimethyl-benzyl ammonium chlorides, 1:1000	5 but not 10[2]	5 but not 10[3]	6.43[4]
Bacili kil	5 but not 10	Less than 5	
Hexylresorcinol	30+	30+	3.80
Tincture merthiolate 1:1000	30+	Less than 5	9.65+
Tincture metaphen 1:200	10 but not 15[5]	Less than 5[5,6]	10.37+
Pepsodent	30+	30+	2.58
Zonite	25 but not 30	15 but not 20	10.25

[1] Glass electrode determinations.
[2] A 1:1,400 dilution, based on the dry solid.
[3] A 1:2,200 dilution, based on the dry solid.
[4] pH of the normal 10 per cent aqueous solution.
[5] In stock approximately 1.5 years at M. I. T.
[6] Tincture metaphen purchased December 14, 1936.

A study of Table III reveals the significant action of alkyl-dimethyl-benzyl ammonium chlorides in the presence of 50 per cent serum at 20°C. Bacili kil was second to the ammonium compound in efficacy with tincture metaphen third. Hexylresorcinol, tincture merthiolate, pepsodent and zonite did not destroy Staph. aureus in twenty-five minutes in the presence of 50 per cent serum.

At 37°C., germicidal efficacy was greater than at 20°C. as would naturally be expected. Alkyl-dimethyl-benzyl ammonium chlorides, bacili kil, tincture merthiolate and tincture metaphen destroyed Staph. aureus in less than five minutes. The other chemical agents did not destroy the test organism in fifteen minutes.

Germicidal Action against B. Subtilis. In determining the germicidal efficacy of the chemical compounds towards Bacillus subtilis, saline suspensions of the growth on agar slants were made by adding 10 c.c. of normal saline to each slant culture, scraping the growth loose with a nichrome needle and transferring the suspension to a sterile empty tube. To render it homogeneous, the suspension was shaken vigorously. In some of the later work, sterile glass beads or broken glass were added to aid in breaking up the growth.

One-half c.c. of the suspension, brought to the temperature of the test, 37°C., was added to 5 c.c. of an antiseptic, or a dilution of it, and the tests accordingly carried out in the usual F. D. A. manner, except that the time intervals were varied.

Metaphen, merthiolate and alkyl-dimethyl-benzyl ammonium chlorides demonstrated marked bacteriostasis in respect to B. subtilis. Spores present in subculture tubes containing broth would not germinate over a period of several days. Sub-subcultures were necessary to determine true germicidal efficacy.

At a pH of 8.6 or greater, a 10 per cent aqueous solution of alkyl-dimethyl-benzyl ammonium chlorides destroyed the spores of B. subtilis in less than thirty minutes in most tests and in one test in less than fifteen minutes. A longer period of time was usually required to destroy spores when the pH of the ammonium compound was 6.43 or lower.

Tincture metaphen (1:200) failed to destroy suspensions of spores, prepared from cultures grown on agar slants for two days or longer, in thirty minutes. In one test, using a suspension prepared from a twenty-four-hour culture of B. subtilis, sterility was effected in seven and one-half but not five minutes.

Merthiolate (1:1000 tincture and 1:1000 solution) did not destroy the spores of B. subtilis in forty-five minutes under the conditions of the tests.

Phenol, 5 per cent, and pepsodent failed to destroy the spores in twenty-five hours.

CONCLUSIONS

As a germicide, alkyl-dimethyl-benzyl ammonium chloride was considerably more effective towards Staph. aureus at both 20°C. and 37°C. than the market products, which included tincture metaphen (1:200), tincture merthiolate (1:1000), hexylresorcinol and pepsodent.

In the presence of 50 per cent blood serum, the ammonium compound showed greater efficacy at 20°C. towards Staph. aureus than any of the agents with which it was compared—bacili kil, hexylresorcinol, metaphen, merthiolate, pepsodent and zonite. At 37°C. and under similar conditions, the ammonium compound, bacili kil, metaphen and merthiolate were most effective.

Tincture metaphen (1:200), alkyl-dimethyl-benzyl ammonium chlorides, and pepsodent were most efficacious towards E. coli at 20°C. and 37°C. Metaphen was less active than the ammonium compound at 20°C., but was more active than this compound at 37°C.

Spores of Bacillus subtilis were not destroyed as rapidly or in as high dilution as vegetative cells of bacteria. Metaphen (1:200) and the ammonium compound (a 1:10 alkaline solution) were most active in destroying the spores. Phenol (1:20) and one market compound did not destroy the spores in twenty-five hours.

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HEAD INJURIES: A TREATISE FROM THE VIEWPOINT OF DIAGNOSIS, PROGNOSIS AND TREATMENT*

JAMES H. WATT, M.D., F.A.C.S.

Associate Visiting Surgeon, Queens General and Mary Immaculate Hospitals

LITTLE NECK, LONG ISLAND

WE have purposely omitted the use of the words "fractured skull" in this discussion because the presence or absence of skull fracture is, after all, not of vital importance in a consideration of head injuries. It is vitally important, however, to determine as early as possible the nature and extent of any injury to the intracranial contents.

Munro and Leary, of Boston City Hospital, estimate that 20 per cent of all patients admitted to the Hospital for head injury have some degree of subdural or extradural bleeding. We have all seen cases with extensive skull fracture who are never very sick, and recover fully with minimal treatment. Conversely, we have seen cases with no skull injury and extensive subdural bleeding, with many fatalities.

The well known syndrome of middle meningeal hemorrhage is too well recognized to render much discussion necessary. It is, of course, secondary to fracture of the temporal bone, and represents a comparatively small percentage of intracranial injuries. Kennedy, in a recent survey, found it to occur about once to every six cases of subdural hematoma. One point worth mentioning is that in cases of extensive middle meningeal hemorrhage, the primary unconscious period may run directly into the third period or stupor without the intervention of the so-called lucid interval; this type of case, of course, requires early decompression.

We feel that division of intracranial lesions in a general way into expanding or non-expanding lesions is the most rational classification both from the point of view of diagnosis and treatment.

NON-EXPANDING LESIONS

1. *Concussion.* There are many definitions of concussion. The one that impresses me the most is that "it is a molecular disarrangement." It usually occurs in children and athletes, who fall relaxed. The diagnosis of true concussion really depends upon the fact that after recovery there are no subjective signs or symptoms. Such true concussion is probably rare and since it can only be positively diagnosed after complete recovery it is unwise to make such a diagnosis on admission. There is no doubt that many patients classified as victims of post-traumatic neuroses are really suffering from chronic subdural hematoma. It is also true that most of these unfortunates at the time of their original injury were diagnosed as having a slight concussion. It is our firm belief that every patient who has been rendered unconscious requires a bed rest of at least three weeks.

2. *Congestion and Edema.* There is an increase in cerebral volume but no blood cells in the subdural space to blockade the pacchionian villi.

EXPANDING LESIONS

Laceration and Contusion. With this pathology, there are at least some blood cells in the spinal fluid and a tendency to blockade, although a few cells can, of course, be removed by phagocytes. In its mildest form this lesion is really a non-expanding lesion.

By their very nature, clots tend to increase in size; this is particularly true in the case of subdural clots which become covered with a fibrovascular membrane,

* Read before the Regional Fracture Committee, Fracture Day at Queens General Hospital, April 27, 1937.

the "neo-membrane" of Leary. This membrane is semipermeable, and by osmosis, cerebrospinal fluid enters it, increasing its size, until the specific gravity inside the membrane approaches that of the cerebrospinal fluid. It is of comparatively recent date that subdural hematoma has been accorded the importance that it merits.

From this brief review, it can be seen that non-expanding lesions tend to recover spontaneously and expanding lesions are the reverse.

If a case diagnosed as a non-expanding lesion does not show the expected improvement, be ready to revise your diagnosis.

DIAGNOSIS

The diagnosis of epidural hemorrhage with its period of initial loss of consciousness (often only momentary) followed by the lucid interval and then by slowly increasing loss of consciousness, is well known.

The diagnosis of subdural hematoma presents more difficulty, but it is usually not insurmountable.

There are several signs which should place us on the *qui vive* for subdural hemorrhage, of which the most important are: lapsing in and out of consciousness; one dilated pupil; ocular palsies; hemiparesis; blurring of the disc; increased cerebrospinal fluid pressure; and rigidity of the neck. Cases diagnosed as non-expanding lesions, that do not improve as expected must also be included.

Spinal punctures are essential for proper diagnosis. That withdrawing spinal fluid will increase bleeding is not entirely true. The bleeding is as likely to be venous as arterial, and by decreasing venous pressure, bleeding tends to cease. The presence of blood in the fluid is of great diagnostic and prognostic importance.

TREATMENT ON ADMISSION

Place the patient in bed; record his condition as to consciousness, coma, spasm, flaccidity, pupils, ocular fundi, pulse, respiration and blood pressure. If the systolic pressure is below 60, treat for shock. Give transfusion or acacia, if necessary.

In the case of open wounds, palpate for skull fracture, pack with Dakin's gauze, and apply occlusive dressings. Do not irrigate. Do not irrigate ears or nose if rhinorrhea or otorrhoea is present.

When shock is past, do a careful neurologic examination.

A spinal tap should be done if the patient is drowsy or unconscious. If the cerebrospinal fluid pressure is elevated, reduce it by half the excess.

When indicated, institute proper measures to reduce intracranial pressure, such as 50 per cent glucose or sucrose intravenously, magnesium sulphate by rectum, elevation of the head of the bed and repetition of the spinal puncture as indicated. If after two or three spinal taps, the pressure remains elevated, suspect a subdural clot.

With signs of cortical pressure, Jacksonian convulsions, motor or sensory aphasias, hemiparesis or Babinski sign, decompression is indicated. It should also be borne in mind that decompression may become necessary for the patient with a diagnosis of non-expanding lesion if the condition follows a retrograde course or does not show the expected improvement.

Do not give morphine.

Do not disturb for *x*-rays.

It may be well to call attention to the fact that while dehydrating the brain, we may also dehydrate the body to a dangerous or even fatal degree. If the patient cannot take adequate fluid—a quart a day—it must be supplied by clysis. Dehydration alone will give all the symptoms of the most severe head injury. We have seen several cases of patients who remained stuporous with an elevated temperature after the blood and spinal fluid pressure were normal, recover almost miraculously after one intravenous feeding of fluid. This is particularly true in patients who have been subjected to extensive dehydrating treatment.

In regard to decompression, we feel that it must always be bilateral. It is very difficult to localize a subdural clot preoperatively, and we may have more than one clot; we must explore both sides.

CONCLUSIONS

1. The early evaluation of the type and extent of intracranial injury is of prime importance.

2. Serious intracranial injury can and does occur in the absence of skull fracture.

3. Subdural hemorrhage is more common than epidural hemorrhage.

4. Subdural bleeding frequently occurs with no skull fracture.

5. Spinal punctures done at the proper time in the proper manner are an essential part of our diagnostic, prognostic and therapeutic armamentorium.

6. The indications for different types of treatment are presented.

The encouragement and constructive criticism of Dr. Frank N. Dealy in preparing this article are appreciated.

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NEUROGENIC SARCOMA*

HERMAN CHARACHE, M.D.

Assistant Visiting Surgeon, Cumberland Hospital; Associate Radiation Therapist, Brooklyn Cancer Institute

BROOKLYN, NEW YORK

ALTHOUGH neurogenic sarcomas are comparatively rare, they occur with sufficient frequenty to constitute a vital surgical problem, not only in the general hospital, but in institutions where a special study of tumors is made. Ewing[1] states that "the serious nature of the deeper neurofibromas is very imperfectly realized by most surgeons so that the number of victims of the disease is much larger than is generally believed. The primary attack on these tumors must be undertaken with great caution."

Neurogenic sarcomas are soft tissue tumors which, according to Verocay,[2] and Mason and Simard,[3] arise from the sheath of Schwann. Ewing and many others believe that the majority of fibromas and fibrosarcomas are of neurogenic origin. They are encapsulated, freely movable tumors, recur locally and do not infiltrate, but extend along the course of the nerve or one of its branches to the neighboring structures.

Metastasis is, as a rule, late and infrequent. The lungs are the most common site of metastasis, while the regional glands are very seldom involved. About 50 per cent of the reported cases were found in the extremities, half of these in the lower extremities. The other sites in order of frequency are: the chest wall, abdomen, gluteal region, scalp, neck, and axilla.

The tumors vary in size from a cherry to a large football. The majority of the smaller ones are of many years' duration, but do not increase in size or cause any disturbance until they are exposed to trauma or incomplete surgery. At such a stimulus they grow very rapidly, break down, and become necrotic and foul smelling.

Histologically, Quick and Cutler[4] divide the neurogenic sarcomas into three types:

Grade 1. Acellular, fibrous tumors composed of large spindle cells, lying in a dense stroma of hyaline fibrous material. Cells few in number, stroma abundant. (Low grade of malignancy.)

Grade 2. Cellular tumors composed of large spindle cells arranged in compact intertwining bundles with whorl formation, very little intercellular substance, and cells predominant. (Moderate grade of malignancy.)

Grade 3. Very cellular tumors composed of small spindle cells arranged in whorls and fasciculi, or polyhedral cells growing diffusely in a loose fibrillar network. (Highly malignant.)

There is no characteristic symptom of the disease. Pain and the fear that the growth may be cancerous are the chief factors that bring the patient for medical advice. Sex is evidently only a slight factor, since there is but a small preponderance in males. Multiple neurofibromas have been known to occur in members of the same family. A great number of the reported cases have occurred in individuals under forty.

The treatment of neurogenic sarcoma has to be undertaken with great caution. The general tendency to excise all palpable or visible superficial tumors for therapeutic and diagnostic purposes should be condemned, particularly the small symptomless neurofibromas of many years' duration, not increasing in size and not exposed to irritation. Such procedures, instead of

* From the Brooklyn Cancer Institute, Dr. Ira I. Kaplan, Director, Division of Cancer, Department of Hospitals, New York City.

preventing a small, innocent fibroma from developing into "cancer," stimulate it to undergo sarcomatous changes. This has

Fig. 1. Case 1. Neurogenic tumor of thigh.

Fig. 3. Case xvii. Neurogenic tumor of scapular region. A, exposed scapula partially eroded.

been found to occur in about 12 per cent of cases (Garre[5] and Fischer[6]).

Radical "one-stage" surgery—wide excision or amputation—is the treatment of choice. Excision of small nodules in surgical clinics or office practice should be condemned. In 75 per cent of such cases the

Fig. 2. Case xiv. Neurogenic sarcoma of axilla.

surgery is incomplete, with consequent recurrence and metastasis. Radiation therapy has proved to be ineffectual. Regaud[7] and his co-workers at the Radium Institute of Paris conclude that most of these tumors are radio-resistant, regress slowly, and are sterilized with difficulty. They recommend surgery as the treatment of choice and restrict the use of radiation therapy to the non-operative cases and as a postoperative procedure. Stewart and Copeland[8] believe that postoperative irradiation of an encapsulated neurogenic sarcoma is not altogether logical. It is their opinion that recurrences are new tumors, and "one is then faced with the situation of having irradiated fruitlessly normal or quasi-normal tissues without destroying their tendency toward new tumor development, and one still has a growing tumor to irradiate after having used up the irradiation tolerance of the local tissue in irradi-

TABLE I

REPORT OF NINETEEN CASES OF NEUROGENIC TUMORS

Case	Race, Sex and Age	Location	Duration before Treatment	Symptoms	Metastases	Treatment	Type of Tumor	Result
1. Y. H.	White, female, 52.	Upper third of right thigh. Three ulcerating necrotic cauliflower tumors each 4 × 6 cm.	5 years	Pain, tumor.	None	Excised three times. *X*-ray therapy.	Fibrosarcoma	Died two years later.
2. M. M.	White, female, 50.	Upper third of left thigh. Ulcerating tumor 8 cm. in diameter.	5 years	Pain, tumor.	None	Excised three times. *X*-ray therapy. Gold seeds.	Fibrosarcoma	Recurred twice. Alive five years.
3. J. S.	White, male, 45.	Upper third of left thigh. Tumor 4 × 4 cm. surrounded by small nodules.	15 years	Pain, tumor.	None	Excised once.	Neurofibroma	No recurrence. Alive three years.
4. D. G.	White, Male, 50.	Left upper thigh. Tumor 4 × 6 cm.	25 years	Pain, tumor.	Lung	Excised once. *X*-ray therapy.	Neurogenic sarcoma	Died four years later.
5. M. F.	White, male, 20.	Upper third of left thigh. Tumor 15 × 19 cm. Ulceration necrosis.	14 years	Pain, tumor.	None	Excised four times. *X*-ray therapy. Radium implantation.	Neurogenic sarcoma	Recurred four times. Died two years later.
6. B. L.	White, female, 66.	Right thigh. Tumor size of football.	3 years	Pain, tumor.	Retroperitoneal.	Radium, *x*-ray therapy.	Fibrosarcoma	Died six months later.
7. R. G.	White, female, 14.	Upper third of left thigh and gluteal region. Ulcerating cauliflower growth.	12 years	Pain, tumor.	Retroperitoneal.	Excised three times. *X*-ray therapy.	Neurogenic sarcoma	Died one year later.
8. F. K.	White, female, 55.	Left buttock. Tumor 13 × 8 × 8½. Ulceration necrosis.	2 years	Pain tumor.	Lung	Excision, *x*-ray therapy.	Neurogenic sarcoma	Died one year later.
9. V. S.	White, male, 13.	Left buttock. Tumor 5 cm. Ulceration necrosis.	8 months	Pain, tumor.	Retroperitoneal.	Excised twice. *X*-ray therapy.	Neurogenic sarcoma	Recurred twice. Died one year later.
10. J. C.	White, male, 27.	Upper third of both thighs and both arms.	11 years	Pain, tumor.	Brain, retroperitoneal glands. (Autopsy.)	Amputation of two fingers one year previous.	Neurogenic sarcoma	Died one month after admission.
11. B. C.	White, male, 47.	Right thigh. Tumor size of grapefruit.	10 years.	Pain, tumor.	None	Excision.	Fibrosarcoma	Alive two years.
12. A. B.	White, female, 25.	Lower outer third of left leg. Tumor 5 cm.	2 years	Pain, tumor.	None	Excision, *x*-ray therapy.	Fibrosarcoma	Alive six years. No recurrence.
13. O. S.	White, male, 50.	Upper third of left leg. Tumor 4 cm. in diameter. Ulceration.	4 years	Pain, tumor.	None	Excised twice. *X*-ray therapy.	Neurofibroma	Alive two years. No recurrence.
14. E. R.	White, female, 22.	Right axilla. Ulcerating necrotic cauliflower growth 6 × 3 cm.	5 months	Pain, tumor, ulceration.	None	Excised twice. Implantation of radium. *X*-ray therapy.	Neurogenic sarcoma	Alive two years. No recurrence.

TABLE I (*Continued*)

Case	Race, Sex and Age	Location	Duration before Treatment	Symptoms	Meta3tases	Treatment	Type of Tumor	Result
15. C. U.	White, female, 35.	Right axilla, Tumor size of orange. Four nodules 3 × 2 cm. along median nerve.	12 years	Pain, tumor.	Extension along median nerve.	Excised twice.	Neurogenic sarcoma	Died three years later, shortly after giving birth to monster in fifth month of pregnancy. Clinical signs of cerebral metastasis.
16. Z. W.	Negro, female, 57.	Right scapular region. Tumor 4 × 6 cm. Ulceration necrosis.	31 years	Pain, tumor, ulceration necrosis.	Lungs	Excised six times. Radium and *x*-ray therapy.	Fibrosarcoma	Recurred six times. Died four years later.
17. G. W.	Negro, female, 15.	Left scapular region, cauliflower growth.	3 years	Pain, tumor.	Lungs	Excised six times. Radium and *x*-ray therapy.	Neurogenic sarcoma (autopsy)	Died seven years later.
18. H. B.	White, female, 53.	Abdominal wall, left upper quadrant.	7 years	Pain, tumor.	None	Excised twice. *X*-ray therapy.	Neurofibroma	Recurred twice. Alive seven years.
19. A. P.	White, male 49.	Lobe of each ear. Tumor 2 cm. Ulceration	6 months	Pain, tumor, ulceration.	New nodules over both ears.	Excision, *x*-ray therapy.	Neurofibroma	Primary lesion healed. Alive four years.

ating something which was not there." James Ewing states that "little aid in their control can at present be expected from the ordinary methods of employing *x*-ray or radium as an adjuvant to surgery."

The prognosis of neurogenic sarcoma should be very favorable, considering that these tumors are circumscribed, very rarely metastasize, and in the majority of cases are easily accessible to surgery. Yet the number of five-year cures reported in the literature is far less than in carcinoma of the breast with all its potential widespread metastases. However, carcinoma of the breast is treated with more caution and "respect." Very few surgeons will do a simple mastectomy for carcinoma of the breast, while the majority of neurofibromas

FIG. 4. Case XVII. Autopsy specimen of metastatic neurogenic sarcoma of lungs.

are looked upon with contempt as "simple fibromas" and treated with simple excisions. As Quick and Cutler state: "Because of their comparative rarity, the general surgeon does not encounter them with sufficient frequency to be familiar with their true nature. Their innocent appearance and accessibility to removal provide an inviting setting for a simple excision." The patient succumbs to progressive cachexia resulting from repeated operations and recurrences. Pain, necrosis, infection, local disability and pulmonary metastasis are contributing factors to the cause of death.

ANALYSIS OF CASES

1. Nineteen cases of neurogenic tumors are reported.

2. Eleven occurred on the extremities (57.9 per cent), two in the scapular region (10.5 per cent), two in the axilla (10.5 per cent), two in the gluteal region (10.5 per cent), one on the abdominal wall (5.2 per cent), and one on the ear (5.2 per cent). Of the eleven tumors on the extremities, eight were on the thigh (72.7 per cent).

3. The duration of the tumor before treatment was as follows:

No. of Years	No. of Cases
31	1
25	1
15	1
14	1
12	2
11	1
10	1
7	1
5	2
4	1
3	2
2	2
0.6	1
0.5	1
0.4	1

4. Fifteen patients (79 per cent) first noticed the tumor before any other symptoms. Four (21 per cent) had pain before the appearance of the tumor.

5. Eleven patients (57.9 per cent) had from one to six "excisions" and as many recurrences before they were admitted.

6. Eleven were female (57.9 per cent) and eight were male (42 per cent).

7. Seventeen were white (89.5 per cent) and two were colored (10.5 per cent).

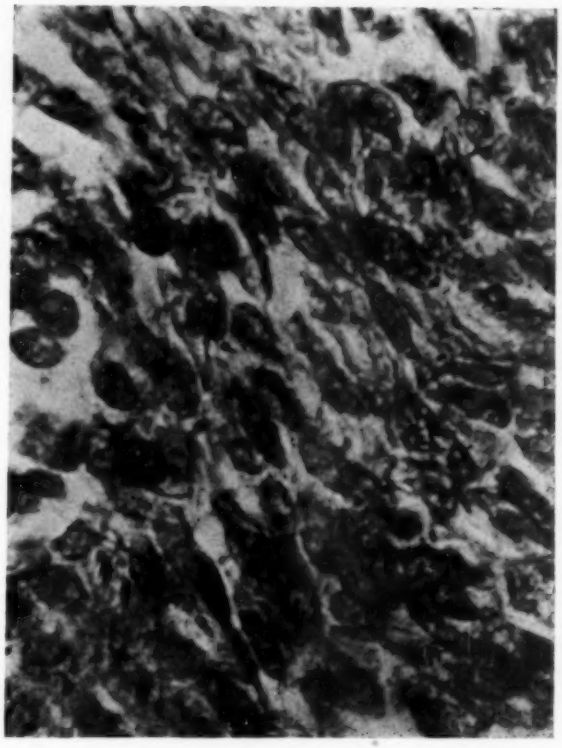

Fig. 5. Case xvii. Photomicrograph of metastatic neurogenic sarcoma of lungs, high power.

8. The youngest patient was 2 years old when the tumor first appeared; the oldest was 63 years.

9. Of all the cases admitted, ten received postoperative *x*-ray therapy alone, one received *x*-ray therapy and implantation of seeds, four received postoperative *x*-ray therapy and radium, two surgery alone, one *x*-ray therapy and radium only. One died shortly after admission.

10. Four patients developed pulmonary metastases (21 per cent), three developed retroperitoneal metastases (15.8 per cent) and one developed cerebral metastasis (5.2 per cent).

11. Eleven patients died (57.9 per cent) while eight remain alive (42 per cent).

12. Of those that died, six had tumors of the thighs, two of the gluteal region, two of the scapular region, one of the axilla.

13. In the cases of those that died, the duration of life after treatment was as follows:

Years of Life	No. of Cases
7	1
4	2
3	1
2	2
1	3
0.5	1

One died shortly after admission.

14. Of those that are alive, the years of cure are as follows:

Years of Life	No. of Cases
7	1
6	1
5	1
4	1
3	1
2	3

COMMENT

The series of cases reported is too small to warrant any conclusion about the management of this type of tumor. However, it is hoped that when added to those cases already reported, they will form an important link in the study of the disease.

SUMMARY

1. Neurogenic sarcoma is comparatively rare.

2. The clinical and pathologic characteristics are described.

3. Radical surgery—wide excision or amputation—is the treatment of choice.

4. Small tumors of many years' duration, not exposed to irritation, should be left alone.

5. Removal of small nodules in surgical clinics or office practice should be condemned.

6. Prognosis of neurogenic sarcoma is poor because a subcutaneous nodule is not accorded the same respect as a nodule in the breast.

7. Nineteen cases of neurogenic tumors are reported.

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CASE REPORTS

CANCER OF THE RIGHT AND LEFT COLON*

ARTHUR BOWEN, M.D.

LOS ANGELES, CALIFORNIA

APPROXIMATELY 8 to 11 per cent of all carcinomata are found in the intestinal tract. Only about 5 per cent of intestinal carcinoma is found in the small bowel, while 80 per cent occurs in the rectum, and 15 per cent in the flexures, cecum, and colon.[3] Statistical reports indicate that carcinoma of the large bowel occurs almost as frequently as carcinoma of the stomach.[9]

Practically all malignancies of the intestines are primary in origin and show a lesser tendency to metastasize than carcinoma elsewhere. Malignant lesions of the colon, in most instances, are single—except those which arise from malignant degeneration accompanying multiple polyposis. The two mobile segments of the colon, the cecum and sigmoid, are most frequently involved. Carcinoma of the colon is jealously partial: if it chooses the right side of the colon, it most often involves the junction of the cecum and hepatic flexure. It shuns the ileocecal valve, and hence obstruction is rare.

Cancer of the colon apparently predominates in males. Dixon[5] finds that at the Mayo Clinic men have been affected twice as frequently as women. Malignancy of the large bowel increases in frequency as one passes from the cecum to the rectum. Cancer appears practically eight times as frequently in the sigmoid and rectum as elsewhere in the colon. Most of the malignancies involving the colon are primarily adenocarcinomas.

The right half of the colon differs from the left in the following respects:

Anatomically—the blood supply to the right half through the ileocecal artery is very constant. The supply to the left half does not have overlapping branches, and is variable and inconstant. The lymphatic supply of the right colon is relatively scant, while the lymphatic supply to the left is more abundant and free.

Physiologically—the right half of the colon is the absorbing segment, and in this is comparable to the small intestine with which it has a common embryologic origin. The function of the left half is that of storage and evacuation.

Pathologically—the malignancies involving the right side of the colon, especially the cecum, are large, very cellular, do not encircle the bowel, and ulcerate early. Obstruction occurs relatively late. Malignancies involving the left usually are small, scirrhous, have a tendency to encroach upon the lumen, producing obstruction relatively early, but ulcerations occur late. Acute obstruction is infrequent in right-sided lesions, but common in the sigmoid. Rankin[15] states that although about one-third of colonic malignancies occur in the sigmoid flexure, approximately one-half of the acute obstructions are found in this location, and in only 6.3 per cent of cases is the site of obstruction in the cecum. Lesions of the right half of the colon are relatively benign, and metastasize later than those on the left. Extension to the liver occurs infre-

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quently from lesions of the right colon, but is found frequently in the left-sided lesion.

SYMPTOMS

The symptomatology of cancer of the colon depends upon the character and location of the tumor; whether it encircles or encroaches upon the lumen of the intestine; whether it is ulcerative or non-ulcerative; whether it is located in the proximal or distal half of the colon. The average duration of symptoms is shortest in cancer of the descending colon and longest in cancer of the cecum.

Constipation, colic, and obstruction are predominant features of colonic tumors in general, occurring in from 40 to 50 per cent of cases; diarrhea is noted in a substantial number by all observers.

Rankin,[14] on the basis of symptomatology, divides cases of cancer of the right half of the colon into three distinct groups: (1) the dyspeptic group, usually diagnosed as chronic appendicitis or "intestinal indigestion"; (2) the group characterized by anemia and weakness of unexplained origin; and (3) the group in which tumefaction is accidentally discovered in the course of routine examination, without having previously produced symptoms.

While anemia is present in all malignancies of the large bowel, it is most marked in those involving the cecum. The tendency to anemia is not only greater in cancer of the cecum, but there is a definite gradation in the anemia-producing property of cancers situated at successive points along the colon, growths in the proximal colon producing anemia and cachexia earlier than those in the distal colon. The anemia is apparently not due to the loss of blood, since few of the cecal carcinomas produce macroscopic bleeding. Alvarez[1] suggests that the anemia may be due to the presence of highly infectious and virulent bacteria bathing the ulcerated cecum. Indeed, a marked secondary anemia may be the outstanding finding for a considerable time, and the existence of an unexplained anemia should direct one's attention to the right colon. It is interesting to note that: (1) when these tumors are short-circuited and left, the hemoglobin usually returns to normal; (2) that the complete removal of the right half of the colon does not give rise to anemia; and (3) that tuberculosis of the cecum with extensive destruction does not at all produce a comparable anemia.

Pain in malignancy of the colon is a characteristic symptom, and as a rule is found much earlier in the course of development of cancer of the flexures and distal colon than that of the cecocolon. Localized tenderness is in most cases present rather early in the course of malignancy and becomes more marked when secondary infection supervenes.

Tumefaction in the colon is rarely due to fecaliths; occasionally due to tuberculosis and diverticulitis; and most frequently to new growth.

Indigestion and loss of weight occurs late in the distal colonic lesions, but is noticed earlier in the cecocolon—probably due to intoxication from absorption of toxic products of the infected ulcerated lesion and interference with the proper absorption in the cecocolon.

When the data of symptoms from the various locations are tabulated, the following symptoms are highest in incidence on the right side and decrease as the rectum is approached, viz.: anemia, indigestion, localized pain not relieved by bowel movements, and palpable tumor.

The syndrome of neoplastic growths of the left half of the colon is evidenced by acute, sub-acute, or chronic obstructive symptoms. The left colon is narrower; fecal material is solid; the left-sided growths tend to encircle and constrict the bowel; hence obstructive symptoms predominate. The sequence of symptoms is: mild attacks of discomfort associated with gas and colicky pains, moderate constipation, diarrhea, gradual obstruction, episodes of acute obstruction, and final complete blockage.

Melena and tenesmus occur more frequently in left-sided growths than else-

where. Rectosigmoid cancer presents an accentuation of the symptoms of the left colon, with a sharp rise in the number of patients observing blood in the stools and a paradoxical decrease in anemia.

The following features are lowest in incidence on the right side and increase as the rectum is approached, viz.: average duration of symptoms, constipation and colic, diarrhea, and macroscopic bleeding.

DIAGNOSIS

Next to a carefully taken history and physical examination, the most important aid in the diagnosis of lesions above the rectum is the *x*-ray. The symptoms to emphasize are not those which indicate that cancer is surely present but those which might lead to a suspicion of cancer. There is too great a tendency to think of colonic cancer in terms of pain, obstruction, constipation and diarrhea, but these are late symptoms. It must be taught and emphasized that dyspepsia, loss of appetite, loss of weight, and obscure anemia are much more common early symptoms. *Any change in bowel habits, or passage of macroscopic blood is suggestive of cancer.*

Diagnosis of cancer of the rectum can be made in 100 per cent of cases. Eighty per cent of cancers originating even as high as the rectosigmoid junction can be felt by digital examination; the remaining 20 per cent can be diagnosed by proctoscopic and sigmoidoscopic examination, and by barium enema. Many of these cases have been treated for colitis, amebiasis, injected for hemorrhoids, or subjected to colonic irrigations, without digital or proctologic examination. The negative barium enema should not be regarded as diagnostic, since a majority of the tumors of the rectum do not show a filling defect. Biopsy should be taken to confirm the diagnosis, and to determine the grade of malignancy. A negative report is a demand for another biopsy, especially if the growth feels and looks like cancer.

Adenomata and polypi, no matter how small, should be regarded as possible cancer, a section taken for examination, and the tumor thoroughly cauterized.

As surgery is the only cure—and then only when done early—the problem of early diagnosis is of paramount importance in the treatment of cancer of the colon and rectum.

DIFFERENTIAL DIAGNOSIS

Cancer of the colon must be differentiated first, from inflammatory lesions, appendicitis, adnexal diseases, and colitis; secondly, from tuberculosis, syphilis and actinomycosis; thirdly, from functional disorders.

Benign and malignant tumors of the cecum and ascending colon in the early stages frequently produce signs and symptoms which so closely simulate those of appendicitis that the differential diagnosis becomes most difficult. While the similarity is most commonly encountered in inflammatory and tuberculous lesions, it also occurs in ulcerative carcinoma with secondary infection. Erdmann and Carter[8] reported a series of eighteen cases of tumor of the cecum, five of which had previous operations for recurring appendicitis. Rosser,[16] reviewing 138 cases of right sided cancer, states that in more than two-third of the cases, the symptoms simulated chronic appendicitis. Fifteen per cent of the Priestly-Bargen[12] group of 100 cases, and 18 per cent of Brindley's series of cases had been subjected to appendectomies.

CASE HISTORIES

The following brief extracts of case histories are taken from the Surgical Services of the Cedars of Lebanon Hospital, Los Angeles, California. These illustrate the common differential points.

Case 1. A female, aged 57, was admitted to hospital after a seizure of severe cramp-like pain the day before. Some nausea and vomiting were present, but there was no fever or chill. Neither urinary symptoms or diarrhea were reported. Pain was localized in the right lower quadrant and there was marked tenderness over McBurney's point. The leucocytes numbered 15,000 with 81 per cent polys. Hysterectomy had been done ten years ago, but the

patient did not know whether the appendix had been removed.

A diagnosis of acute appendicitis was made. Operation on the day of admission disclosed a large sausage-shaped mass involving the ascending colon and cecum. Resection and ileocolostomy were done. The pathologic diagnosis was adenocarcinoma.

Case II. An adult male of 49 was admitted to the hospital complaining of cramp-like pain in the right lower quadrant for the previous six months. He had lost 20 pounds in the past five months, and suffered from weakness, constipation and vomiting 10 to 15 minutes after meals. Eight months before he began to notice night sweats.

The temperature was normal. Red blood count was 4,500,000, with hemoglobin 83 per cent. The white count was 7,300, with polys 65 per cent.

Examination revealed a sausage-shaped mass in the region of the cecum and a tentative diagnosis of tuberculous cecum or carcinoma was made. Gastrointestinal *x*-ray revealed a spastic pylorus and a constriction in the ileocecal region. A barium enema showed a narrowing at the junction of the cecum and ascending colon. Urographic examination showed normal outline and function of the urinary tract. *X*-ray of the chest showed bilateral apical tuberculosis. The preoperative diagnosis was probable carcinoma of the cecum. The postoperative diagnosis was an appendiceal abscess which was found and drained. Three months later the patient was readmitted and an appendectomy was done.

Case III. The patient was a man of 35 with a history of intermittent attacks of right lower quadrant pain for the past six months. He reported no nausea or vomiting, and no change in bowel habits. He had lost 15 pounds in weight. The temperature was normal and there was no blood in stools.

One month prior to admission he had two severe attacks of pain with nausea and vomiting. He was seen by one of the senior attending men privately and sent in to the clinic for removal of a chronic appendix.

The author saw the patient upon admission, and found tenderness on deep palpation over McBurney's point. There was no rebound or rigidity, and no masses could be felt. The blood differential was normal; red corpuscles were 4,720,000, hemoglobin 83 per cent. Rectal examination was negative.

While examining the lower abdomen I noticed a puckered scar in the left inguinal region. The patient, on questioning, recalled that he had had an abscess in the groin at the age of 7. Further questioning revealed that he had had trouble with his spine at age of 3, when he had been hospitalized and placed in a cast for several months.

With a history of Pott's disease and a left psoas abscess, the possibility of a beginning burrowing, right-sided cold abscess was considered and operation was postponed. *X*-ray of the chest and spine were made. Those of the chest were negative, but those of the spine showed kyphosis of the second, third, and fourth lumbar vertebrae without active lesion. At operation a large mass partly fixed at the head of the cecum, with regional glandular involvement, was found.

The history made us incline to an operative diagnosis of tuberculous cecum, and resection and ileocolostomy were done. The pathologist's report was, however, adenocarcinoma.

We are here again reminded that cases of so called chronic appendicitis should not be operated upon until gastrointestinal and genitourinary studies have been made.

Case IV. A woman, aged 49, had had a cholecystectomy five years previous. Two weeks before admission she began to have lower abdominal pain, without nausea, vomiting or fever. On examination, a moderate rectocele and cystocele were found, with a large mass filling the pelvis to the brim. This was apparently an ovarian cyst or pedunculated fibroid. The patient was admitted for repair of the perineum and removal of the mass. The cystocele and rectocele were repaired; upon opening the abdomen, a carcinomatous mass about 3 inches in length and 1½ inches in diameter was found surrounding the sigmoid about 10 inches from the anal orifice.

Case V. The patient, a female aged 53, complained of fleeting pains in the left lower quadrant a few days before. No constipation, no diarrhea, and no blood in the stools were reported. The past history was irrelevant. Examination disclosed an obese woman who complained of tenderness on deep pressure in the left lower quadrant. A movable mass was located along the region of the descending colon. There was a mass in the lower sigmoid and also a cystic left ovary.

X-ray examination with a barium enema showed the cecum markedly enlarged and

elongated. A diverticulum was present at the junction of the descending colon with the sigmoid. Carcinoma and diverticulitis were considered as possible diagnosis.

At operation a mass about 3 inches in diameter was found at the rectosigmoid junction, evidently at the point of rupture of the diverticulum. The mass could be freed by dissection. Frozen section was done, and a report of inflammatory tissue was made.

Comment. An inflammatory mass produced by diverticulitis may thus sometimes be difficult to differentiate from carcinoma clinically, on *x*-ray, and even on gross inspection within the abdomen. The inflammatory mass, which frequently surrounds the malignancy of the rectosigmoid as a result of seepage through the ulcerating gut wall, may confuse the operator as to its mobility and removal. It is surprising, however, after detouring the fecal current by a preliminary colostomy, how the mass shrinks and becomes more mobile. What appeared to be an inoperable fixed growth, becomes a removable one.

Case VI. A female, age 62, had a history of increase in size of the abdomen, noticed in the past two weeks. She was chronically constipated and reported obstipation for the previous two days. There was no pain, no nausea, vomiting, or bloody stools.

Red blood corpuscles numbered 4,950,000; the hemoglobin was 83 per cent; white blood cells were 13,200 with polys 64 per cent.

Examination showed a moderately well nourished adult female—not acutely ill. The abdomen was generally and regularly enlarged. A mass the size of a large grapefruit could be felt in the right lower quadrant, extending upward on right side. The mass was fluctuant, slightly cystic and tender. The liver and spleen were not palpable and no fluid wave was present. A cystic mass could be felt in the right cul-de-sac on vaginal examination. It extended behind the uterus but was separate from it, and was tender on deep pressure. Rectal examination was negative except for a mass in the right cul-de-sac.

X-ray examination (a flat plate taken by the attending physician) showed a tumor mass lying in the pelvis, with some distention of the sigmoid and transverse colon, probably due to pressure.

The increase in size of the abdomen in a woman of 62 with a palpable cystic mass in the right lower quadrant and cul-de-sac, confirmed on vaginal examination, led me to make a preoperative diagnosis of right ovarian cyst.

Operation disclosed a large paper thin cystic mass occupying the right lower quadrant and pelvis. In following up its origin, it was found to be a tremendously dilated cecum and ascending colon over 6 inches in diameter. The transverse colon was dilated and filled with hard fecal matter. A search was made for the point of obstruction which must always be below the distended gut. A hard circular constricting growth was found in the rectosigmoid junction, but there was no surrounding extension or fixation. No glands were palpable along the aorta and there were no liver metastases. A decompression in the form of a colostomy was done. Three weeks later the patient developed a bilateral parotitis, steadily went downhill and finally expired.

The autopsy, as reported by Dr. Hammack, showed a constricting adenocarcinoma of the rectosigmoid, with a large, dilated, tissue-paper-thin cecum and ascending colon.

Comment. This case illustrates: (1) the vague symptoms of rectosigmoid cancer; (2) the occurrence, as a result of left-sided colonic cancer, of a tumor on the right side due to slow, progressive constriction of the rectosigmoid lumen, producing marked dilatation of the cecum; (3) the repeated tendency of left-sided growths to produce obstructive symptoms and signs.

PROGNOSIS

Five year survivals following successful extirpation of colonic growths are higher than in other types of gastrointestinal malignancies. The average case of colonic malignancy has a better chance of cure than other malignancies with the exception of those of the skin. Adequate preoperative preparation and management play a prominent rôle in reducing the mortality of colonic surgery.

Rankin,[15] reviewing 753 cases of malignancy of the large bowel operated upon at the Mayo Clinic, reported five year cures in 57 per cent of all tumors involving the right colon; 47 per cent in those involving the left colon; and 35 per cent of all lesions involving the rectum.

Cancer of the large bowel when seen early is curable in a large percentage of cases. The

tragedy of the final result lies in the fact that not many over 50 per cent are operable when first seen by the surgeon. Lahey noted that cases coming to his clinic averaged nine months since the onset of symptoms, while Rankin reports an average of ten and one-half months delay from onset of symptoms to surgical consultation. On the other hand, Dixon and Olson[6] report twelve patients who lived for more than twenty years after radical operation for carcinoma of the large intestine.

The size of the growth has little, if anything, to do with the prognosis. The diameters of the growths removed by Rankin[15] in cases of five year cures averaged the same as in those where death occurred as a result of recurrence. Actually cancers of the cecum and ascending colon are the largest of all growths found in the colon—yet it is statistically demonstrable that left colonic lesions are of poorer prognosis than tumors of the right half.

The occurrence of highly malignant lesions in young individuals warrants a guarded prognosis.

Enlarged lymph nodes, more frequently than not, are benign and inflammatory, secondary to the ulceration which is always present in malignancy. Fixation, which sometimes makes one feel that the growth is inoperable, is also more often the result of inflammatory change than of malignant extension.

Rankin[15] believes that the scientific criteria of microscopic grading laid down by Browders estimates more accurately the prognosis of cancer than any other yardstick. Fortunately, the majority of colonic growths fall into the moderate grades of malignancy (1 and 2).

The operative mortality is higher in cancer of the left half of the colon than in that of the right half. Rankin,[15] between 1930 and 1933, did sixty ileocolostomies for lesions of the right colon with four deaths, a mortality of 6.6 per cent. In 1935, he reported[16] eighty-nine radical perineo-abdominal resections for left-sided lesions, with eight deaths, a mortality of 8.8 per cent. He states that graded operative procedures, both in the right and left halves of the colon, may be undertaken with a hospital mortality rate ranging from 5 to 10 per cent without sacrificing the operability ratio.

The outlook for surgical treatment of carcinoma of the colon and rectum is therefore far from hopeless in the cases amenable to surgery.

OPERATIVE PROCEDURE

The surgical management of colonic lesions consists of: (1) decompression; (2) rehabilitation; and (3) resection. Medical decompression is done in the subacute and chronically obstructed colons by means of mild purgations and irrigations for a period of three to six days preoperatively. Surgical decompression is used in acutely obstructed cases, in the form of cecostomy or colostomy. Rehabilitation measures fortify the resistance of the patient, and consist of high caloric, low residue diets, adequate fluid intake and blood transfusions.

Functionally and anatomically, the segments of the colon differ, and therefore the type of operation is adapted to the location of the tumor. The cecum and ascending colon are more easily mobilized than the descending colon. The lymphatic supply of the ascending colon is not nearly so free as that of the descending colon, while the blood supply is so constant that the ascending colon offers, from the standpoint of infection and recurrences, the most hopeful outlook. In malignancies of this segment, the ileocolostomy with immediate or subsequent resection gives the most satisfactory results.

Because the transverse colon is freely movable except at the extreme ends, it is technically the least difficult to resect, but the chances for infection and complications are probably greater than in any other part of the large gut. The blood supply is never constant and the lymphatic drainage is free. In malignancies of this part of the bowel a two-stage operation is practically always advisable.

The descending colon has almost no mesentery except at the sigmoid flexure. The blood vessels do not overlap while the lymphatic drainage is very free. Obstruction occurs early. Graded procedures are most applicable in this segment—a primary colostomy followed by resection from above or below or a combined approach.

SUMMARY

A brief comparison of the right- and left-sided colonic cancers has been made, with reference to pathology, prognosis, symptoms, diagnosis and treatment, and with brief extracts of cases illustrating differential lesions.

CONCLUSIONS

1. Earlier diagnosis of cancer of the large intestine will be made when any changes in the bowel habits will be regarded with suspicion, and when digital and proctoscopic examinations will be made part of every complete physical examination.

2. Five year survivals following extirpation of colonic growths are higher than in other types of gastrointestinal malignancies. Fifty per cent of patients who present themselves early can be cured.

3. The two halves of the colon are anatomically, pathologically, and clinically different.

4. The most common erroneous diagnosis in the presence of cancer of the right colon is unexplained secondary anemia, tuberculosis, cholecystic disease, peptic ulcer, or appendiceal abscess. If the growth is in the left side the erroneous diagnosis is more likely to be colitis, diverticulitis, spastic colon, or adnexal disease. Colitis and hemorrhoids are the most erroneous diagnoses where there is growth in the rectum.

5. On the whole, graded operative procedures for colonic cancer seem the safest, and these can be undertaken with a hospital mortality ranging from 5 to 10 per cent.

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SPONTANEOUS RUPTURE OF A HYDROPYONEPHROTIC KIDNEY SECONDARY TO CALCULOUS OBSTRUCTION OF URETER

ARTHUR A. SALVIN, M.D., F.A.C.S.

Associate Surgeon, Sydenham Hospital

NEW YORK CITY

RUPTURE of the kidney from direct or indirect trauma is not an uncommon occurrence, but spontaneous rupture appears to be rare. Küster[1] reports having found only ten such cases in the course of 30,000 autopsies. Spontaneous rupture usually takes place in the presence of hydronephrosis, chronic nephritis, nephrolithiasis, tuberculosis, abscess formation, tumor, infarct, acute focal infection, hemophilia, or polycystic kidney.

Wade[2] describes a case in which the rupture occurred in an acute nephritic kidney due solely to a rapid and extensive swelling of the organ. His patient was suffering from syphilis and malaria. It was thought that the treatment with mercury caused the acute swelling and final rupture of both kidneys, with fatal outcome.

Spontaneous rupture due to ureteral calculus is a most unusual finding. In 1932 Dourmashkin[3] reported a case and at that time made a careful search of the literature, which revealed only two similar instances, those of Henline[4] and Mathé and Oviedo.[5] The following case which recently came into my hands prompted a further search of the literature, and only one additional case, that reported by James,[6] was found.

CASE REPORT

A. L., female, aged 44, was admitted to Sydenham Hospital on the evening of January 5, 1937, complaining of acute pain in the right side, extreme nausea, frequent vomiting, and painful urination. These symptoms had persisted for forty-eight hours before admission. The patient gave an indefinite history of "kidney and urinary trouble" extending over four years, for which she had previously been hospitalized. No history of trauma could be obtained.

On physical examination the patient appeared to be severely ill and toxic, and the right lumbar region was extremely tender to the touch. Because of her obesity no masses could be determined. The pulse was rapid and faint, temperature 103.8°F., face flushed, hands cold and clammy. The urine obtained from the bladder was bloody.

On cystoscopic examination (January 6, 1937) indigo carmine was seen to escape from the left orifice in powerful jets of excellent concentration, but none appeared from the right side. Catheters (Nos. 6 and 7) met with an impassable obstruction at 25 cm. in the right ureter.

X-ray examination with the catheter in the ureter revealed a large, dense, circumscribed shadow in the upper end of the ureter at the level of the third lumbar vertebra, indicating a calculus. (Fig. 1.)

The urine was densely clouded, with a specific gravity of 1.016, acid reaction, and it contained 1 plus albumin, no sugar, no casts, and many red blood cells. A blood count showed 82 per cent hemoglobin, 4,250,000 erythrocytes, 17,000 leucocytes; bandforms 36 per cent, segmented 56 per cent, lymphocytes 6, and mononuclears 2.

A diagnosis of acute pyonephrosis with impacted stone in the upper part of the right ureter was made, and the patient was immediately prepared for operation. Because of her obesity, spinal anesthesia was decided upon, but the patient was in a terrified condition and requested inhalation anesthesia. Therefore gas oxygen and ether was administered.

Operation. An oblique right flank incision was made, starting at the apex of the angle between the twelfth rib and the spinal muscles, and extending downward in a curve parallel to and above the crest and iliac spine. Incision

was deepened through the oblique, transversalis, and latissimus dorsi muscles. All bleeding points were clamped and ligated. The lumbar fascia was opened; the retroperitoneal fat, together with the peritoneum, was pushed forward so as to expose the perirenal adipose capsule of Gerota. Upon opening this capsule there was a gush of thin sanguinous pus, exactly resembling (as Dourmashkin so aptly expresses it) a "raspberry milkshake." With the help of an aspirator about 300 c.c. of this fluid was evacuated.

The kidney was enlarged, tense, and of a dark purplish color. Deposits of dense scar tissue prevented mobilization, and due to the narrowness of the operative field it was impossible to bring down the adhesions and clamp them before severing. An attempt to free the upper pole of the kidney resulted in a troublesome hemorrhage, which packing did not seem to control. When the upper pole was freed and slightly lifted, a perforation about 1 cm. in diameter was noticed just above the pelvis, through which pus and urine exuded.

At this stage the patient's condition became very poor, and every effort was made to stimulate her. As the operation had to be hurriedly terminated, the kidney was deliberately divided and the upper half removed from the site of the perforation. The pedicle was doubly clamped and the lower part of the kidney removed. The pedicle was then doubly ligated with chromic catgut, and stitch ligatures applied to other individual bleeders. Since the pedicle was very short and inelastic and the adhesions very dense, no search for the stone was made, through fear of dangerously prolonging the operation. One iodoform and one plain gauze pack and one cigarette drain were inserted. The wound was closed in layers, plain catgut used for the lumbar fascia, chromic for the muscles, and plain silk for the skin.

The patient left the operating room in a very low condition and remained so for forty-eight hours. At the end of that time she showed gradual improvement, and the remaining kidney began to function well. Fluid intake and output for the succeeding six days were as shown in the table in the opposite column.

The temperature gradually declined and became normal on the twelfth postoperative day. Thereafter recovery was uneventful, and the patient was discharged for ambulatory treatment of a small remaining sinus on February 1, twenty-six days after operation.

	Intake, C.c. (intravenously)	Output, C.c. (by catheter, patient perspiring profusely)
Jan. 7.	3,550	740
Jan. 8.	2,840	640
Jan. 9.	2,130	870
Jan. 11.	2,890 (intravenously and by mouth)	1,275
Jan. 12.	3,170	1,625
Jan. 13.	2,780	2,450

Pathologic examination of the specimen by Dr. A. A. Eisenberg showed a typical chronic hydropyeonephrosis. The medullary portion of the kidney was largely destroyed. The cortex was atrophic, but no abscesses were present. The wall and entire mucous membrane of the pelvis and calices were involved in a "diphtheritic" inflammation with scattered hemorrhages. Actual casts of the membrane could be removed. Sections cut through the line of perforation showed complete necrosis of an area measuring 1 × 0.75 cm. (Fig. 2.)

The patient was last seen on April 14, 1937. The wound was entirely closed, and she appeared happy and in the best of health.

As this condition is so unusual, a brief outline of the four other cases will be given.

Dourmashkin's case was almost exactly similar to the one described above. The patient was a man of 56, who gave a history of stone passed spontaneously thirty years previously. His symptoms led to a tentative diagnosis of calculous pyonephrosis or perinephritis, and despite the patient's low condition an immediate operation appeared to be the only chance to save his life. At operation, a large collection of sanguinopurulent fluid was found beneath the capsule, and nephrectomy was decided upon. Before this could be accomplished, however, the patient expired, notwithstanding all means of stimulation. Pathologic examination revealed a contracted kidney with a linear fissure running from the upper calyx to the surface of the organ, and a large, impacted calculus in the upper part of the ureter.

In the case of Mathé and Oviedo, a man of 32 came to the hospital complaining of

nausea and vomiting and an excruciating pain in the right lumbar region. He had suffered a similar attack of pain four

Fig. 1. Roentgenogram of right kidney, showing location of calculus in the upper portion of ureter.

months previously. A very tender mass was palpable over the right kidney, and there was tenderness on deep pressure in the right costovertebral angle. Because of the patient's weak condition no pyelogram was made, but the clinical and *x*-ray findings suggested a diagnosis of "urinary calculus." At operation, the pelvis was found to be ruptured just above the uretropelvic junction, which contained a large impacted stone. The aperture was enlarged by incision and the stone removed. Drainage was applied to the pelvis and the incision closed. This case was complicated by jaundice, which cleared up soon after the operation, but the temperature remained high for eighteen days and it was necessary to widen the incision to secure better drainage. Convalescence was hampered by the development of a severe brachial neuritis persisting for thirty-four days. The patient was finally discharged with a slight hernia in the incision.

Henline's case was that of a man 42 years old, who gave a history of syphilis, urethral stricture, and urinary calculus. The patient was admitted in a very critical condition. A discolored swelling extended into the lower abdomen, the scrotum, the penis, and upward into the right side of the back. A preoperative diagnosis of extravasation of urine with urethral obstruction was made. Incisions into the perineum, scrotum, and penis and over the suprapubic region disclosed multiple abscesses, and drainage was applied at these points. The patient failed to rally and expired on the fourth day after operation. Autopsy revealed a rupture of the uppermost calyx of the right kidney, which extended through the fibrous capsule and contained three small stones. A calculus 1 cm. in diameter obstructed the right ureter at about 8 cm. below the ureteropelvic junction.

The author felt that if the patient's condition had permitted a cystoscopy and thorough investigation, a correct diagnosis would probably have been made, and early drainage of the perirenal abscess might have saved the patient's life.

James reports the case of a woman 67 years of age, who complained of severe generalized pain with vomiting of twenty-four hours' duration, and pain in the left loin for three weeks previous to admission. She gave a history of bladder stones two years before. Examination showed symptoms of a general peritonitis. A hard, tender mass extended from the left costal margin to the left iliac fossa and back into the loin. A preoperative diagnosis of general peritonitis due to rupture of a pyonephrosis was made. When the peritoneal cavity was opened through a small suprapubic incision, a large quantity of offensive pus was evacuated. An incision in the left loin revealed a large pyonephrosis. Drainage was applied, but the weak condition of the patient precluded more radical treatment. After a temporary improvement, the patient died on the following day. Autopsy revealed a generalized peritonitis. The left loin was filled with a large, multilocular pyonephrotic kidney, and a large branched calculus was

found impacted in the pelvis and the upper end of the ureter. A perforation through the lower pole of the kidney opened into the peritoneal cavity.

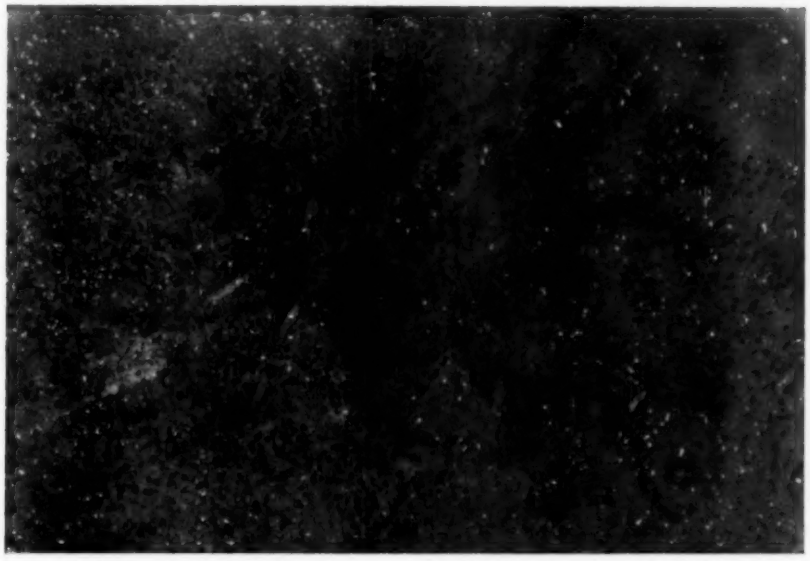

Fig. 2. Photomicrograph showing necrosis of tissue at the point of rupture.

CONCLUSIONS

From this small collection of cases, the difficulty of making a preoperative diagnosis of ruptured kidney will be seen. In only the last case was it correctly done. The condition is usually marked by severe nausea and vomiting, which Abeshouse[7] attributes to a reflex stimulation of the splanchnic nerves. The temperature is elevated, alternating with chills, and the patient frequently shows signs of collapse. The urine may show a trace of albumin, a few blood cells, and some casts. Pain is sometimes generalized at first over the whole abdomen, and this in conjunction with nausea, vomiting, and flatulence may lead to a mistaken diagnosis of some intra-abdominal lesion. The presence of a mass with extreme tenderness over the loin is the most important diagnostic sign of a ruptured kidney.

It may be said, however, that an accurate diagnosis is not of the greatest importance if indications for an exploration are recognized and operation done without delay. On discovery of a ruptured kidney, the surgeon must make a decision between immediate nephrectomy and a two-stage operation. In the writer's opinion, immediate excision of the diseased organ is the ideal procedure. This, however, entails considerable risk of puncturing the peritoneum, since, in pathologic conditions of the kidney where dense adhesions are likely to be present, the peritoneum is difficult to identify. Also the condition of the patient is frequently such as to make him a poor surgical risk. If the remaining kidney is also diseased and unable to take over the entire burden of excretion, the prognosis is very unfavorable. Some authorities prefer to make a preliminary drainage and postpone the decision as to radical operation until a later date. Mathé and Oviedo, however, regretted not having done an immediate nephrectomy in their case, in view of the necessity for subsequent incision, the prolonged convalescence, and the serious complications which followed conservative treatment.

The presence of a stone high up in the ureter constitutes a grave menace. Abeshouse states that a large stone in the upper urinary tract may set up an extensive ulcerating process and produce a localized area of necrosis which serves as an admira-

ble site for spontaneous perforation. The rupture occurs as a result of sudden or gradual alteration in the increased back pressure caused by the obstructing stone.

These cases with their high rate of mortality may suggest a closer watch upon patients having a history of urinary calculi. Early operation in the presence of the symptoms outlined above may be the only means of saving the patient's life.

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For the medical student, the autopsy provides the first introduction to the abnormal, and the basis for much he will learn throughout his course of study.

From—"The Postmortem Examination" by Sidney Farber (Thomas).

SIMULTANEOUS EXTRA-UTERINE AND INTRA-UTERINE PREGNANCY*

REPORT OF A CASE AND REVIEW OF THE LITERATURE

J. I. SLOAT, M.D. AND LEONARD T. PETERSON, M.D.

Lieutenant Colonel, Medical Corps, U. S. Army — Captain, Medical Corps, U. S. Army

HONOLULU, HAWAII

SIMULTANEOUS combined intra-uterine and extra-uterine pregnancy is a rare condition and has been the subject of several excellent reports. The extra-uterine pregnancy may be ovarian, abdominal, or tubal. The condition is to be distinguished from intra-uterine pregnancy superimposed on an older ectopic pregnancy which has resulted in lithopedion formation. The latter is known as compound intra-uterine and extra-uterine pregnancy, of which Bland recorded 197 cases.

Stein cites Mann's case: "A nullipara, age 33, was delivered of living triplets from the uterus; the fourth or extra-uterine child grew to term, but died and was retained thirteen years." Cases of living twins associated with extra-uterine pregnancy have been recorded. Novak recorded nine cases in which simultaneous extra-uterine and intra-uterine pregnancy has resulted in infants born alive. The first recorded case of simultaneous extra-uterine and intra-uterine pregnancy was by Duverney in 1708, discovered at autopsy in a woman who died in the third month of a ruptured ectopic pregnancy.

In 1913 the literature, reviewed by Neugebauer, contained 244 cases. Further reports were made by Novak in 1926, reviewing thirty-four cases since 1913 and including two of his own; by Stein in 1928, reviewing thirty-six cases since 1913, including one of his own; and by Gemmell in 1933, reviewing 212 cases in the literature, with two personal cases. Of the number reported, some have been summarized by all the authors, others by only one author. An analysis of all the cases (Table 1) reveals that the above authors recorded sixty-four separate cases since 1913 which, added to Neugebauer's figure, make a total of 308 summarized to date. The authors have gathered fifteen additional reports from the literature which have not appeared in previous tabulations and are reporting one original case, making a new total of 324. This does not include one report (Vineberg) of early ovarian pregnancy in which the diagnosis of uterine pregnancy was not substantiated by microscopic study.

CASE REPORT

M. L. (68848 and 70116), age 30, mother of four children, the youngest aged 10, was first admitted to Tripler General Hospital at noon November 1, 1935. She stated she had had some intermenstrual bleeding in the fall of each year since 1931. The last normal period began September 17. One week after the period, vaginal bleeding began and continued moderately until admission. She had suffered pelvic pain and had been confined to bed most of the last month, but she had not sought medical advice.

She had moderate abdominal pain and tenderness at the preliminary examination, but within an hour after arrival she suddenly developed more severe pain and went into shock. A diagnosis of intraperitoneal hemorrhage, probably from ruptured ectopic pregnancy, was made, and operation was performed at once.

The blood pressure was 94/74, pulse 124, white blood cells 42,500 with 92 per cent polymorphonuclears, and hemoglobin 60 per cent.

At operation there was a large amount of intraperitoneal blood originating from a ruptured left tube which contained a well formed

* Read before the Honolulu County Medical Society, November 6, 1936.

fetus 6 cm. long. The tubal mass was excised and cornual section of the right tube was also done. It was noted that the uterus was soft and about the size of a two month pregnancy, but an intra-uterine pregnancy was not suspected, it being thought that the disproportion in size was due to uterine hyperemia which is the usual feature in ectopic gestation.

The patient was given a transfusion of 500 c.c. of citrated blood at operation and her condition improved rapidly.

On November 6, five days postoperatively, she developed uterine contractions and passed blood and clots. Twelve hours later she expelled tissue and a fetus 7 cm. long, a little larger than the ectopic fetus. The bleeding ceased and she was discharged November 20. She was not seen again until she was readmitted March 9, 1936, almost four months later. Although she lived within a few blocks of the hospital, she had not sought medical attention in the meantime. She stated that there had been a little vaginal bleeding ever since she left the hospital and three weeks before admission it became severe. She became progressively weaker and on admission she had a severe anemia with red cell count 2½ million, hemoglobin 45 per cent. A diagnosis of retained placental tissue from intra-uterine pregnancy with incomplete abortion was made. The uterus was subinvoluted and the cervix was soft and dilated. Curettage was done under nitrous oxide anesthesia and a large amount of placental tissue was removed. She recovered and left the hospital in a few days.

TABLE I
CASES REVIEWED SINCE 1913

Date	No.	Author	Novak (1926)	Stein (1928)	Gemmell (1933)
1913	1	Claverie	+	−	+
	2	Weiss and Sencert	+	−	+
	3	P. Fabris	+	−	+
	4	N. L. L.	−	−	+
	5	Brackett	−	+	+
	6	Desgouttes	−	−	+
	7	M. Vautrin	−	−	+
1914	8	Demelin and Kleim	+	−	−
	9	F. Primsar	+	+	+
	10	Primsar	+	+	+
	11	Gibson	+	−	+
	12	Bogdanovics	+	+	+
	13	Rouvier	−	+	+
	14	Smyly	−	+	−
1915	15	Tandberg	+	+	+
	16	W. D. MacFarlane	+	+	−
	17	F. G. DuBose	+	+	+
	18	J. Heyman	+	+	+
	19	J. Heyman	+	−	+
1917	20	H. J. Boldt	+	+	+
	21	E. A. Sullivan	+	+	+
	22	Oastler	−	+	−
	23	Unterberger	−	+	+
1918	24	A. H. Curtis	+	+	+
1919	25	M. Fenger	+	+	+
1920	26	K. Hornung	+	−	−
	27	Stropeni	+	+	+
	28	Nijhof	−	+	+
1921	29	C. M. Rolston	+	+	+
	30	Lukins	−	+	+
1922	31	A. Sippel	+	+	+
	32	Colistro	+	+	+
	33	Colistro	+	+	+
1923	34	Berry	+	+	+
	35	Auvray and Delater	+	−	+
	36	J. M. Keys	+	+	+
	37	Duponchel	−	+	+
	38	Paroli	−	+	+
	39	Paroli	−	+	+
1924	40	Mathews	+	−	+
	41	Angeli	+	−	+
	42	Nash	+	−	+
	43	Reeb	−	+	+
	44	Turolt	−	+	+
1925	45	L. deAraujo	+	−	+
	46	Lowthian	−	+	−
	47	Novak	+	−	+
	48	Novak	+	−	+
	49	Fitzgerald	−	−	+
	50	Page and Terey	+	−	+
1926	51	J. N. Furniss	+	−	−
	52	Barendrecht	−	+	+
	53	Hermans	−	+	+
	54	Schwartz	−	+	+
	55	Schwartz	−	+	+
	56	Stiglbauer	−	−	+
1927	57	Stein	−	+	+
	58	S. E. Berman	−	−	+
1928	59	P. H. Rulle	−	−	+
1929	60	Duncan	−	−	+
1931	61	A. Modiano	−	−	+
	62	Perdu, Christian	−	−	+
	63	Wilson J. St. G.	−	−	+
	64	White C.	−	−	+

ADDITIONAL CASES NOT PREVIOUSLY TABULATED

1. Prose, Werner, 1925. Patient age 28 had had three pregnancies all of which aborted at two months, the last in May 1923. She entered the hospital March 15, 1924 for abdominal pain and uterine hemorrhage of three weeks' duration. The cervix was dilated; blood clots and a 7 cm. fetus were removed. This was followed by abdominal operation with removal of the left ovary and the left tube containing a fetus. One year later, March 2, 1935, she was delivered of a normal child.

11. Brandon, W. H., 1927. A Negress, age 26, was admitted with pain in the right lower abdomen. The last menstruation, July 4, 1926, was abnormally scanty and lasted only one day. Pain began August 10. She was operated on for a ruptured tubal pregnancy, estimated at ten weeks' duration. The intra-uterine

pregnancy went to term and she was delivered 214 days later on March 21, 1927.

III. Gilliam, Earl M., 1927. The mother of five living children had been pregnant twelve times and had had five miscarriages. She was four months pregnant. After two weeks of symptoms, she was operated on for ectopic pregnancy February 22, 1914. The pregnant uterus was not disturbed and she was delivered of a normal baby girl August 14, 1914.

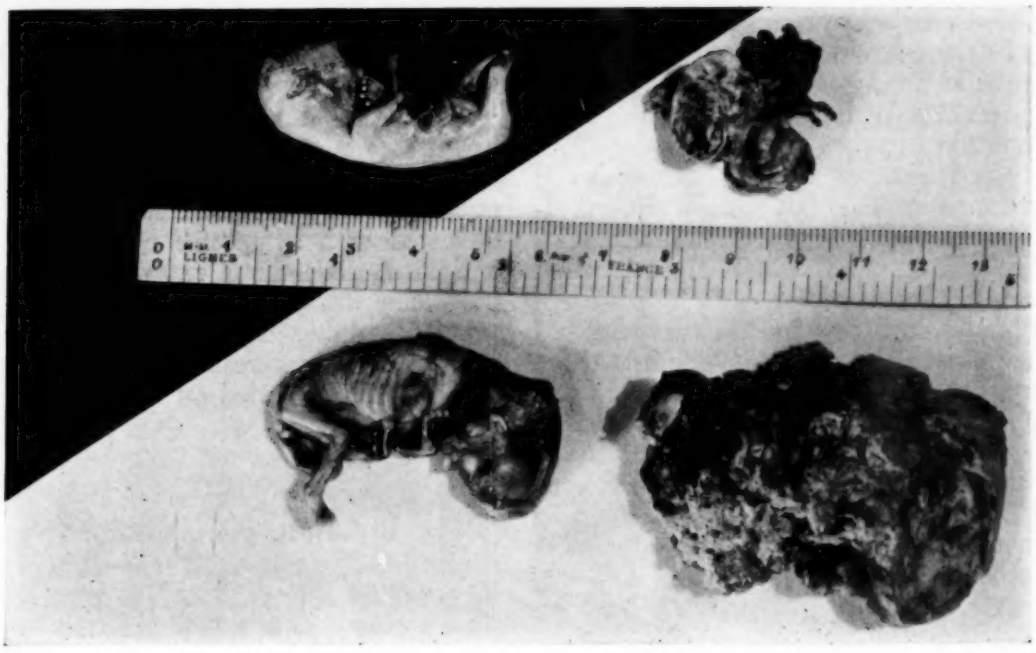

FIG. 1. Embryos in case reported. Top, ectopic pregnancy and ruptured tube. Bottom, intra-uterine pregnancy and portion of placenta.

IV. Hoffman, R. I., 1927. This patient was 25, married three years, had had no pregnancies; appendectomy had been done three years previously. Ten days after the cessation of menses hemorrhage became severe and was associated with left abdominal pain. The left tube was enlarged on examination. In the third month the uterus was evacuated in spite of a diagnosis of pregnancy because of the tumor in the left tube. The tube was then removed and it was found to contain a pregnancy.

V. Komiches, M. I., 1927. First case: A 29 year old woman, married eight years had had two pregnancies with abortions in the second month of gestation. In December, 1926, after a two months period of amenorrhea she developed acute symptoms and was operated on for extra-uterine pregnancy. Nausea continued and in March, 1927, a diagnosis was made of four-month intra-uterine pregnancy. Sexual life was not resumed until April 10. The uterine pregnancy went to term with normal labor.

VI. Komiches, M. I., 1927. Second case: The patient was a physician, age 23, with normal menstruation. She had been married five years, and had had one pregnancy with delivery at term, in 1924. Last menses was in February 1927. On April 24 she had a sudden onset of abdominal symptoms and was operated on for right tubal pregnancy with removal of the right tube. Five days later she had a miscarriage, and pregnancy was confirmed by macroscopic and microscopic examination.

VII. Raggi, James, 1927. A woman of 26, married eleven years, with three children, the youngest 4, had had two miscarriages. Menses were normal for the previous year except for menorrhagia the last ten days. She was admitted August 6, 1924, on account of right abdominal pain of two weeks' duration. Examination disclosed a moderately enlarged uterus and a right adnexal mass. A ruptured right tubal pregnancy was removed at operation. She came under observation again June 9, 1926, with symptoms suggestive of left ectopic pregnancy, the last menstruation having been April 21. She aborted a 2½ inch fetus July 1. The abdominal symptoms became more acute and she was operated July 10, and a left tubal

pregnancy was found. The diagnosis was confirmed on microscopic examination.

VIII. Miller, H. P., 1928. The patient, age 37, had three normal labors nineteen, nine and seven years previously. Last menstruation, one month before, was scanty. She had abdominal pain with spotting for three weeks and examination revealed a right tubo-ovarian mass. At operation this was removed and the pathologic report was "tubal pregnancy." The uterus was of three months' size, but intra-uterine pregnancy was not suspected. She went to term and was delivered of a normal male child six and a half months later.

IX. Oastler, F. R., 1928. The patient suffered repeated attacks of abdominal pain without bleeding. She had an acute intraperitoneal hemorrhage, after which a left tubal pregnancy of two months' duration was removed at operation. The uterus was enlarged and soft, and intra-uterine pregnancy was suspected. She miscarried three and a half months later without further complications.

X. Borta, G., 1929. This patient, aged 31, had normal menses, was married eleven years, and had seven pregnancies, the fifth and sixth of which terminated in abortion and the last in delivery three years previously. The last menses occurred May 4; there was a slight bloody show June 15 and acute abdominal pain June 24. Six days later diagnosis of ruptured left tubal pregnancy was made, and was confirmed by operation. The size of the uterus was not noted. She had an incomplete abortion August 19, followed by curettage.

XI. Schubert, G., 1929. The patient was 26. Two months after delivery of a normal infant an ovarian tumor was removed at operation. It contained a papyraceous fetus of four months.

XII. Thulin, E., 1929. First case was in a septipara, age 39. A ruptured tubal pregnancy of two months was removed at operation. Intra-uterine pregnancy was not suspected. Two months later uterine hemorrhage occurred and a 9 cm. fetus was removed by curettage.

XIII. Thulin, E., 1929. The second case was in a secundipara, age 27, in the second month of intra-uterine pregnancy. Torsion of the left adnexa or left extra-uterine pregnancy was diagnosed. The later condition was found at operation and was confirmed by pathologic examination. One month later she expelled a 13 cm. fetus. The abortion was completed by curettage.

XIV. Crimeni, V., 1932. A primipara, aged 32, was operated on following a diagnosis of extra-uterine pregnancy. A right adnexal mass containing an embryo was removed. The uterus was enlarged and an intra-uterine fetus was palpable. The following day she expelled a five months fetus.

XV. Tomasi, Luigi, 1934. The patient had had two normal deliveries, followed by delivery of twins. Subsequently there were abortions at two and three months respectively. She was admitted with symptoms of peritonitis and anemia. A diagnosis of ruptured extra-uterine pregnancy was made. At operation a ruptured tube containing a two months fetus was removed, and hysterectomy was done. Section of the uterus revealed an intact two months fetus.

SUMMARY

The literature on simultaneous extra-uterine and intra-uterine pregnancy has been briefly reviewed and the total number of cases since 1913 has been corrected. One original case is reported with a summary of fifteen additional cases since 1925, making a total to date of 324.

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The reasons usually given for refusal of autopsy permission should be known by the doctor, and answers to such objections should form part of his armamentarium. Permission is refused most often on religious or sentimental grounds or because of the opposition of special groups, such as undertakers.

From—"The Postmortem Examination" by Sidney Farber (Thomas).

TWISTED OVARIAN CYST IN A THREE YEAR OLD CHILD*

HARRY E. ISAACS, M.D., AND ALBERT M. SCHWARTZ, M.D.

Surgeon, Beth Israel Hospital — Assistant Surgeon, Beth Israel Hospital

NEW YORK CITY

THE literature contains numerous reports of twisted ovarian cysts in children,[1,2,3,4,5,6,9,12] but the great majority of these cases occurred in patients between the ages of 9 and 14. Only few instances of this entity have been reported in very young children. In view of its general interest and the diagnostic difficulties which the syndrome presents, the following brief survey of the literature and case history are published.

A thorough review of the American and English literature up to 1905 was made by Wiehl[14] who found sixty-one cases of twisted ovarian cysts in children of all ages; he later found thirty-eight more cases from that year to 1925. Ohmstede,[13] in his survey of German literature, gathered only twenty cases from 1900 to 1927. Of these one hundred and nineteen cases, eleven were in children under 3 years of age, an incidence of 13 per cent. Less than half of this number were operated upon successfully. That this condition can occur in very young infants is evidenced by the report of Doran, who found an ovarian cyst in a seven months premature baby (quoted by Steele[8]). Cases of twisted cysts have been recorded in infants of four months (Baron[7]), twenty-one months (Leveuf[10]) and two years (Obdalek[11]). The last two patients were operated upon and made uneventful recoveries.

Many cysts remain unrecognized in early childhood due to the fact that the majority cause no symptoms until the child is much older. The factors which indicate their presence are usually great increase in size of the cyst, pressure on neighboring pelvic organs and occasionally mechanical obstruction of the rectum or bladder. Frequently, the existence of any pelvic abnormality is unknown until a grave complication sets in, such as rupture of the cyst, suppuration or torsion, the last mentioned being the most common. Only with the occurrence of one of these catastrophic developments is attention focused upon the pelvis. For a reason still obscure, the incidence of right-sided ovarian cysts with torsion exceeds that of the left, and consequently the condition is most often considered an acute appendicitis, usually with abscess formation. In only four of a series of twenty-seven cases collected by Steele[8] in 1931 was the correct diagnosis made preoperatively. In the case reported below, torsion of an ovarian cyst was considered as a differential diagnostic possibility from the more obvious diagnosis of appendiceal abscess, for which the laparotomy was undertaken.

CASE REPORT

J. P., a 3 year old girl, was admitted to the Beth Israel Hospital, New York City on December 12, 1936, with a history of intermittent pain in the lower abdomen for two weeks. The past history was negative except for measles one year prior to admission, and a tonsillectomy six months later. Two weeks before admission the patient was suddenly seized with severe right lower abdominal pain; she vomited once. An enema was given with only poor result. The pain continued intermittently for two days, during which time the patient was very restless and unable to sleep. At the end of the second day an oil enema was given, this time with fair result. The pain then gradually disappeared, only to return one week later accompanied by vomiting. There had been a persistent right lower quadrant pain since that time, and during the few days preced-

* From the Surgical Service of Beth Israel Hospital, New York City.

ing admission, dysuria appeared, associated with frequent micturition. There was no history of chill or rise of temperature above 100°F.

Physical Examination. On admission the temperature was 103 degrees, pulse 120 and respirations 26. The positive findings were limited to the abdomen, which was moderately distended, tender throughout, especially in the right lower quadrant. Here, a moderate degree of rigidity was present. A firm, tender, immobile mass, about 3 inches in diameter, occupied the lower right portion of the abdomen, and appeared to extend towards the pelvis. Rectal palpation disclosed a mass along the right side of the rectum, where marked tenderness was elicited.

Laboratory Data. The urine, except for a few white cells, was negative. Leucocyte count revealed 15,400 white blood cells with 58 per cent polymorphonuclear leucocytes.

Operation. A diagnosis of appendicitis with abscess was made, and patient prepared for laparotomy. A right rectus incision revealed a dark bluish discoloration of the peritoneum, under which an ovid mass could be felt. Upon entering the peritoneal cavity, a moderate amount of bloody fluid escaped, and a dark purplish mass about 2 inches in diameter was found arising from the pelvis. This proved to be a gangrenous tube and ovarian cyst twisted several times on its pedicle. The appendix was found resting in a groove between the cyst and tube, and appeared secondarily involved in an acute process, as it was congested, thickened and edematous. The tube and twisted cyst were removed, and the uterine end of the tube was sutured. The appendix was delivered into the wound and removed subserously. The stump was carbolized, alcoholized and whipped over by peritoneum. The abdomen was closed in layers.

Postoperatively the patient did very well, and was discharged on December 21, 1936, cured. She has remained well up to date.

Pathologic Report. (1) Hemorrhagic infarction of tube, ligament and ovarian cyst. (Fig. 1.) (2) Severe periappendicitis.

This case illustrates the diagnostic difficulties encountered in the determination of the etiologic factor of acute processes in the abdomen in very young children. Torsion of an ovarian cyst should be considered when the following symptom complex is found in young girls: history of previous attacks of mild lower abdominal pain preceding the acute seizure; nausea and vomiting; increase in pulse and temperature; rapid development of a mass which can be felt abdominally and rectally; and rigidity and tenderness in the lower abdomen. The presence of an ovarian cyst can be determined before a complication such as torsion sets in, if rectal examinations were made more frequently in children complaining of abdominal discomfort, even in the absence of abdominal signs.

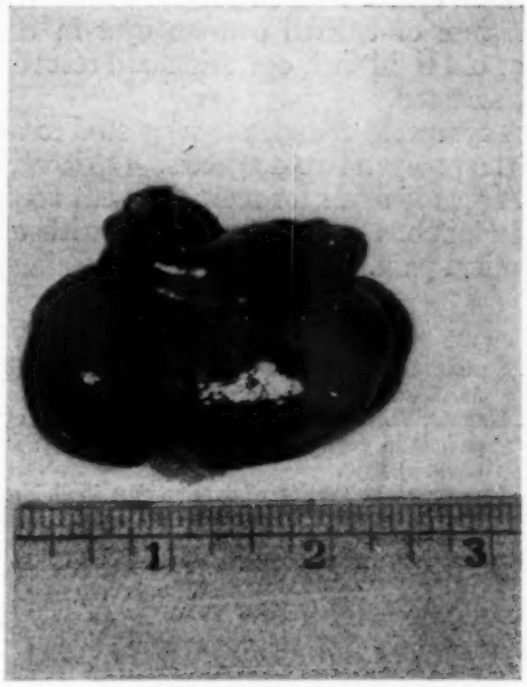

Fig. 1. Specimen removed at operation, showing gangrenous ovarian cyst and tube.

Twisted ovarian cysts in young children undoubtedly occur more frequently than the literature would indicate. These patients are operated upon with diagnoses other than ovarian cysts, usually appendicitis, and the cases have therefore not been gathered and reported as assiduously as other surgical entities.

SUMMARY

A brief review of the literature of twisted ovarian cysts in children is presented.

The condition is most frequently confused with acute appendicitis because of the greater incidence of right-sided twisted ovarian cysts.

A case of twisted ovarian cyst in a 3 year old child with operation and recovery is presented.

A symptom complex is suggested to aid in the preoperative diagnosis.

A plea is made for more frequent rectal examinations in young children with abdominal pain.

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Just as the physician is not liable for honest errors of judgment in his treatment of the patient, so he may not be held culpable for an honest mistake in diagnosis.
From—"The Roentgenologist in Court" by Samuel Wright Donaldson (Thomas).

PRIMARY CHORIONEPITHELIOMA OF THE TUBE

I. TRACTENBERG, M.D.

Attending Gynecologist, Unity Hospital

BROOKLYN, NEW YORK

PRIMARY chorionepithelioma of the tube is rare as evidenced by the fact that only thirty-four cases have been reported in the literature since 1912.

A diagnosis of chorionepithelioma of the tube presents serious difficulties. Certain clinical facts may be helpful and perhaps suggestive if one obtains a correct past history that reveals: (1) several abortions or miscarriages; (2) extra-uterine pregnancy with reappearance of bleeding after several months, accompanied by abdominal pain. (3) an adnexal tumor which is growing rapidly. An Aschheim-Zondek test, particularly with the quantitative determination of gonadatropic substances in the urine, is extremely important in the early diagnosis.

Primary tubal chorionepithelioma is believed by some authorities to develop at the implantation site of a tubal pregnancy. Others believe it may develop by transformation from a benign chorionic embolies lodging in the tubal vessels to malignant chorionepithelioma.

The case herein described is a chorionepithelioma of the right tube.

CASE REPORT

Mrs. L. G., age 40, white, married twenty-one years, the mother of four children (the youngest of whom is 7 years of age) was admitted to the hospital on December 10, 1935.

Her chief complaints upon admission to the hospital were vaginal bleeding, pain in the lower abdomen, backache, and a pressing feeling in the vagina. Menstruation began at the age of 12 and was always regular up to a year before, lasting four days and of twenty-eight day type. Her deliveries were normal in every respect. The last pregnancy, which was seven years previous was a prolonged labor with a retained placenta requiring manual extraction.

She had had three miscarriages within the preceding five years. Careful investigation failed to reveal that material resembling mole was expelled or removed.

About a year before she had missed two periods. There was spotting during those two months with cramp-like pain in the abdomen. Her family doctor made the diagnosis of incomplete abortion and performed a curettage. Two days after the curettage, while in the hospital, she experienced a severe cramp-like pain and felt faint. Glucose was given intravenously and other treatment instituted. Her condition had improved after a three week stay in the hospital. The record of histologic studies of the scraping could not be obtained.

Though there was still intermittent spotting, she insisted upon going home and was discharged at the beginning of the fourth week.

Within the eight months preceding her present admission her periods became irregular. The bleeding lasted for nine or ten days and was quite profuse. After each period she noticed a scant, dark, bloody discharge with a foul odor coming from the vagina.

The physical examination as to her heart and lungs was essentially negative. *X*-ray of the chest was also negative. The patient appeared to be anemic. Abdominal examination showed a relaxed abdomen with marked tenderness in the lower right quadrant. Rigidity and rebound tenderness was also present but not marked.

A tender, soft, movable tumor about the size of a small tangerine was palpable in the lower right quadrant. Vaginal examination revealed a small amount of dark unclotted blood oozing from the os. The cervix was hypertrophied, lacerated and eroded. The uterus was slightly enlarged, movable, displaced slightly to the left by a soft right adnexal mass. The ovaries were not palpable. Urinalysis was negative.

Blood examination showed a hemoglobin of 50 per cent; a red blood count of 2,300,000; a white count of 17,000 with 78 per cent polys. The sedimentation rate was slightly increased. The temperature variation in twenty-four hours ranged from 100 to 101. Pulse was 90 and respirations 24.

A provisional diagnosis of hematosalpinx with glandular hyperplasia of the endometrium was made with suspicion of malignancy. An exploratory dilatation and curettage was done for histologic studies of the endometrial tissue, but the uterine curettage failed to explain the menorrhagia. The hemorrhage ceased, but within about four days began again. An Aschheim-Zondek test was ordered and the report showed very strongly positive. Chorionepithelioma was suspected by the writer, although the scrapings were negative.

Preliminary intravenous glucose was given and under spinal anesthesia a laparotomy was performed in the usual manner the following day. Upon opening the peritoneum and packing away the intestines, we encountered a small amount of serous fluid in the pelvic cavity. A small tumor consisting of a dark, irregular, hemorrhagic mass, friable, was attached by a broad base to the end of the right tube, which was twice the normal size and edematous. This hemorrhagic mass looked like placental tissue.

The right ovary was enlarged and contained a thin wall cyst about 2.5 cm. in diameter. The left tube was normal and the left ovary was somewhat enlarged and cystic. The uterus was of a little more than normal size. Due to these findings, deemed it advisable to perform a total hysterectomy and a salpingo-oöpherectomy.

The immediate postoperative course of the patient was uneventful. On January 15, 1936, after four weeks stay in the hospital, she was discharged in good condition. The Aschheim-Zondek test one week after the operation and before the patient left the hospital was negative.

Fig. 1. Chorionepithelioma of tube, low power.

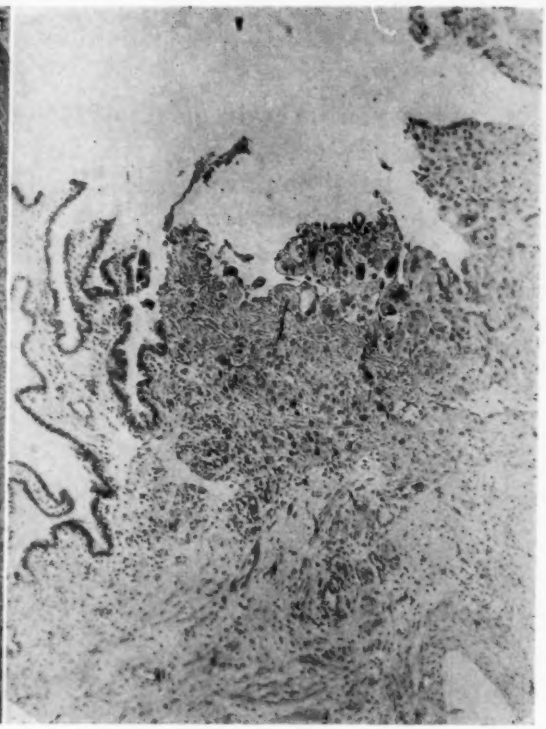

Fig. 2. Same under high power.

Gross Pathology. The uterus was slightly enlarged. When it was opened, the endometrium appeared somewhat congested. At one point, at the right cornea, there was a hemorrhagic infiltration of the uterine mucosa. There was a small amount of bloody discharge in the uterine cavity. The left ovary was slightly above normal size, and on section showed a considerable number of small cysts, most of them filled with hemorrhagic fluid. The left tube was normal. The right ovary was larger due to the larger cyst, with the fluid distinctly hemorrhagic. It also contained a normal appearing corpus luteum in the stage of retrogression. The tube was thickened to twice the normal size with the hemorrhagic mass.

Histologic Examination. The uterine wall did not show any evidence of chorionepithelioma or any trophoblastic tissue. A moderate amount of inflammatory infiltration was

present. No villi or chorionic epithelium were found. At one point there was seen a diffuse decidual reaction. The right tube was edematous. In the middle of the section, the tubal epithelium was replaced by a mass of cells, most of them large, with clear vesicular nuclei. The protoplasm was sometimes vacuolated and here each cell was sharply differentiated from its neighbor. Elsewhere the cells were clumped together in syncytial masses. A few of the cells were smaller and more deeply stained. They had infiltrated the wall of the tube for a little distance. In one place they surrounded a mass of blood clot. The cells were found in the walls of blood vessels.

The diagnosis reported was chorionepithelioma of the tube.

The patient has been under my care since she left the hospital. She has gained considerable weight and with the exception of some manifestations of menopausal symptoms her condition is excellent.

An Aschheim-Zondek test performed monthly has been persistently negative to date.

COMMENT

The history of several miscarriages and a probable tubal pregnancy is of great significance in this case.

The persistence of decidual reaction so long after original pregnancy was probably due to the abundance of trophablastic tissue in the tube and mass.

The multiple lutein cyst in the ovary is usually associated with chorionepithelioma.

The biologic test advanced by Aschheim and Zondek should be utilized on all patients suspected of chorionepithelioma even though the histologic examination of an exploratory curettage is negative.

CARCINOMA DEVELOPING ON EXTENSIVE SCARS*

THE INEFFICIENCY OF PINCH GRAFTS AS A PROPHYLACTIC MEASURE

MAX DANZIS, M.D., F.A.C.S., MILTON FRIEDMAN, M.D. AND LOUIS J. LEVINSON, M.D.

Visiting Surgeon, Beth Israel Hospital

Associate in Radiotherapy, Beth Israel Hospital

Assistant in Radiotherapy, Beth Israel Hospital

NEWARK, NEW JERSEY

THE occurrence of carcinoma on extensive burn or traumatic scars is well known. This entity has recently been well summarized by Treves and Pack. Extensive, thick, dense scars, which are avascular and poorly nourished, do not tolerate mild injuries due to pressure, irritation of clothing, scratching, etc., as well as the normal skin. After a period of years, varying from twelve to twenty, the incompletely developed and poorly nourished skin overlying the scar loses its capacity to repair these minor injuries, and a persistent ulceration develops, which may become malignant.

The essential therapeutic approach to this lesion is through the prophylactic treatment of the original burn or injury. This procedure should be executed by the surgeon as part of the plan of immediate treatment of the injury. The postponement of the treatment for many years may permit the development of a cancer and necessitate more radical therapeutic procedures. Skin grafting is the method of choice in the prophylactic treatment of these scars. Various types of grafts are recommended.

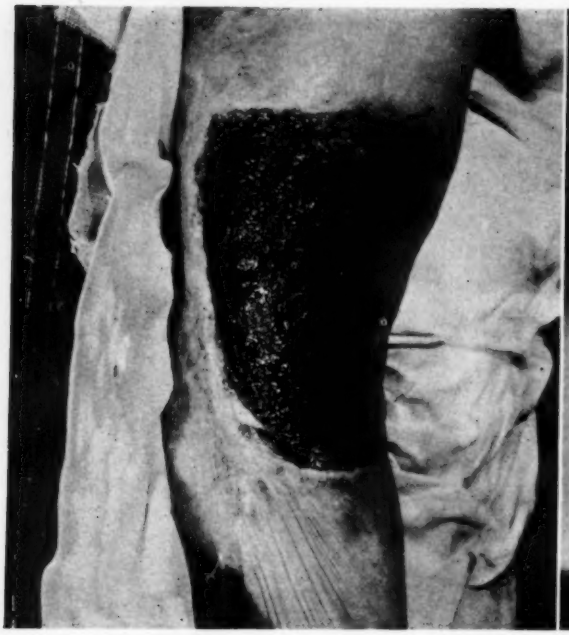

FIG. 1. Case 1. Appearance in April 1932 following the excision of the primary small ulceration and part of the extensive scar, together with the original pinch grafts.

FIG. 2. Case 1. Photograph taken two months after Figure 1, showing recent pinch grafts, in the center of which the epithelioma (E) recurred.

It is the purpose of this paper to demonstrate that "pinch grafts" or "Thiersch grafts" are useless in preventing the

* From the "A" Surgical, Radiation Therapy Department and Division of Laboratories, Newark Beth Israel Hospital, Newark, New Jersey.

development of future carcinomata. As stated by Treves and Pack: "The Thiersch grafts do not simulate normal skin, since none of the skin accessories, such as hair follicles, sweat and oil glands, are present, and consequently the grafted area is dry, without oil, and subject to the same degenerations as scar tissue." They also state, "Cancer has been known to originate on Thiersch-grafted regions." The following two cases further demonstrate this fact:

Case 1. J. L., a white male, sustained severe crushing lacerations of the left thigh in an automobile accident in 1922, when he was thirteen years old. An extensive débridement was performed, *followed by pinch grafts*. The scar on the thigh remained healed until June 1931, when a small bleb appeared on the skin over the site of the transplants. This ulcerated and extended until it reached a diameter of 4 cm. The ulcer was lined with foul-smelling granulations which bled easily. In April 1932, ten years after the original injury the entire ulcer was excised by Dr. Max Danzis. (Fig. 1.) Microscopic examination of the excised tissue showed epidermoid carcinoma, Grade II. The wound filled with granulations, and two months later, two series of pinch grafts were applied. The patient was then referred to the tumor clinic for radiation therapy.

On physical examination, there was found a large scar on the left leg. (Fig. 2.) The group of pinch grafts on the lateral aspect of the recently denuded area was only partially successful. The group on the posterior aspect was completely successful except for an area near its upper part which contained a recurrent carcinomatous ulcer. A bridge of open granulations separates the two groups of grafts. The recurrent ulcer measured 3 cm. in diameter, and was filled with bleeding granulations and slough. Microscopic examination revealed this tissue to be squamous cell epidermoid carcinoma.

Treatment. On June 6, 1932, a wax mold containing radium was applied over the malignant ulcer. The following radiation factors were employed:

Radium: 130 mg. in six tubes.
Distance: 1 cm.
Filter: 3 mm. of lead
Dose: 3,120 mg. hours.

The lesion did not respond very well to radiation and the ulceration continued to progress. On June 11, 1932, the lower extremity was dis-

Fig. 3. Case II. Epidermoid carcinoma occurring years after extensive destruction of skin, which was originally treated with pinch grafts. Patient well three years after amputation.

articulated at the hip joint. Microscopic examination of tissue at the site of the lesion revealed epidermoid carcinoma infiltrating muscle tissue. Following a series of deep *x*-ray treatments to the hip, the patient was discharged on October 29, 1932. On December 20, he was readmitted with a complaint of dypsnea and pain in the chest. *X*-ray examination of the chest showed metastatic involvement of the left lung. The patient expired December 31, 1932.

Case II. J. A., a white male, aged 35, reported to the tumor clinic June 23, 1933. At the age of nineteen he had been pinned under a railroad train, and sustained a severe crushing injury to this right leg. *A débridement was performed and later pinch grafts were applied.* Most of the grafts survived, though it required one year for the injury to heal. An extensive scar remained. In December 1932, fifteen years after the accident, a small open sore appeared in the center of the scar. This ulcer increased in size progressively. On February 2, 1933, a biopsy from the edge of the ulcer revealed hyperkeratosis.

On physical examination there was found a large scar on the posterior and medial aspect of the right leg. In the center of the scar was a large indurated ulcer with a raised granular border. The ulcer measured 6 × 6 cm. The edges were rolled. The base of the ulcer was filled with small hard granulations. (Fig. 3.) Microscopic examination of a biopsy specimen at this time showed epidermoid carcinoma, Grade I.

Treatment. Due to the apparent involvement of the deep fascia and muscle by the epithelioma, radical measures were advised. On July 17, 1933, a mid-thigh amputation was performed by Dr. Max Danzis. The patient made an uneventful recovery and was found in good health on his last visit, October 3, 1937.

COMMENT

Two cases are reported of carcinoma developing upon extensive scars which had been treated originally with pinch grafts. Small pinch grafts of the Reverdin or Davis type are frequently employed because of the simplicity of the operative procedure. Nevertheless, as pointed out by Davis, they are not without their elements of danger. Subsequent contractures in the grafted areas give origin to dense scars which are potential sites for the development of cancer.

The Ollier-Thiersch grafts utilized in extensive wounds present the disadvantage of not simulating normal skin, in that none of the skin accessories, such as hair follicles, sweat and oil glands are present in this type of graft. The resulting grafted area is dry, without oil, and subject to the same degenerative changes as scar tissue.

The ideal type of graft is the whole-thickness graft. These grafts should be carefully studied for adequate blood supply and should be of the pedicle type wherever possible.

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TORSION OF THE CORD IN UNDESCENDED TESTES

TWO CASE REPORTS

H. H. VARNER, M.D. AND J. LEIGHTON GREEN, M.D., F.A.C.S.

Division Surgeon for the Southern Pacific Railroad; Consulting Gynecologist, City-County Hospital

Local Surgeon for the Southern Pacific Railroad; Senior Gynecologist, City-County Hospital

EL PASO, TEXAS

UNDESCENDED testis or cryptorchidism is a common condition, occurring in 0.1 per cent to 0.2 per cent of young adults. Torsion of the spermatic cord is less common, probably 250 cases having been reported, the first by Delasaiauve in 1840. No age seems to be exempt. The youngest case on record was that of Taylor, who noted a swelling in the groin four hours after birth, and operated forty-eight hours later to discover a necrotic testicle. In 1930, Donovan found in the literature thirteen cases of torsion of the cord in infants, and reported three of his own. Many have no doubt been recorded since that date.

Etiology. Thorek found that 47 per cent of the recorded cases were in maldescended organs. Wallenstein noted that 60 per cent of 150 cases occurred in patients with either undescended or maldescended testicles. Four anatomic factors, according to Beller, play an important rôle in the causation of torsion of the testicle: (1) an abnormally loose scrotum; (2) a voluminous tunica vaginalis; (3) an unusually long gubernaculum or retained lengthened mesorchium; and (4) abnormal attachment or location of the cord. Muschat showed that in cases of torsion the cremaster muscle was found to wind spirally around the cord, rather than looping to one side in the normal way. Contraction of the muscle caused rotation.

Symptoms. Usually with torsion of the cord there is intense pain in the groin, which may radiate down the thigh or up the spermatic cord. Nausea and vomiting are frequently present. If the mass is palpable in the inguinal canal a diagnosis of strangulated hernia cannot be ruled out.

The pulse is often rapid. Temperature rarely exceeds 101 degrees. The palpable mass is excruciatingly tender. In general, systemic symptoms—fever, malaise, leucocytosis, rapid pulse—are not in proportion to the severity of the local findings.

Diagnosis. Epididymitis and other inflammatory conditions such as orchitis must be ruled out. Strangulated hernia is probably the most frequent erroneous diagnosis, but this occurs most typically in later life, rarely in infants. However, strangulated hernia and torsion of the cord may occur simultaneously, as happened in our second case.

Epididymitis is uncommon in children; in adults, it may be suspected after obtaining a history of infection. Epididymitis is relieved by lifting the scrotal mass, while this movement increases the pain of torsion. When the diagnosis lies between hernia and torsion of the cord, absence of the testicle from the scrotum should be a warning sign. Orchitis is comparatively uncommon, occurring usually in conjunction with mumps or syphilis or following trauma. Torsion of the cord with the testicle in the scrotum presents a mild degree of tenderness compared with the more acute tenderness of acute infection.

Prognosis. The prognosis in these cases is good, and no fatality has been reported. Usually, however, the testicle has been irreparably damaged before operation, and atrophy is apt to occur regardless of the treatment.

Although non-surgical detorsion of the cord has been done, the accepted treatment is surgery. In case of a testis which appears

viable after detorsion, orchidopexy should be performed. When the testicle is gangrenous, orchidectomy should be done.

CASE REPORTS

The two cases below are thought worth reporting because of the comparative rarity of the condition, and because of the coincidence that both occurred in the same family within a period of two months.

Case I. J. P., a male infant, age 15 months, was brought to Hotel Dieu on August 27, 1936, from a New Mexico town. The child's mother related that on August 25 he seemed to feel ill, refusing to play. On the following morning he cried when placed on the floor, and on standing would not put his left foot to the floor. She detected a tender mass in the left groin, and consulted a doctor, who sent the child to El Paso. The child's previous history was normal except that he had been troubled with "colic," and had suffered recurrent attacks of fever, sometimes accompanied by spasms.

Inspection disclosed a well-developed and well-nourished white baby, crying with pain, his left thigh flexed. The temperature was 100.6°F., pulse rate 110 per minute, respirations 22. Physical examination detected only a mass in the left inguinal region. The tumor was about 2 cm. long, somewhat elongated, was located proximal to the external inguinal ring, and was quite tender. Palpation made the child cry, but did not alter the size or position of the tumor. It was noticed that no testicle was found in the left side of the scrotum, but the right testis was in normal position. There was no rigidity or tenderness of the abdomen above the tumor.

Operation under ether anesthesia was performed on the day of admission. The tumor was found to include the left testis, surrounded by a thickened sac of tunica vaginalis, the mass being deep to the subcutaneous fascia, and about 3 cm. lateral to and above the left external inguinal ring. It was bound with adhesions and was dark and hemorrhagic. The spermatic cord was twisted about 180 degrees. Healthy cord was seen at the ring, which was small and firm. The tunica was incised, and an attempt was made to restore the blood supply of the testis with hot pads. This was unsuccessful. It was necessary to excise the testis, ligating the spermatic cord just outside the inguinal ring. Fascia and skin were sutured without drainage.

After an initial rise of temperature postoperatively to 103 degrees (rectal), the child's recovery was uneventful. He was taken home on September 3, the seventh postoperative day.

Case II. W. P., age four weeks, a brother of the first patient, was admitted to Hotel Dieu on October 22, 1936, exactly eight weeks after admission of the older child. The mother stated that on the previous day, October 21, the baby began to cry, and could not be quieted for four hours. Following this he refused nourishment for the remainder of the day. The patient's bowels, previously active, did not move after the crying had continued for two hours. About seven hours after the onset, the mother noticed a mass in the right groin, and immediately consulted a doctor. The child was referred to us, arriving in the hospital about fifteen hours after the onset. There was no history of previous attacks, and the baby had been apparently normal since birth.

On examination, the infant did not appear acutely ill, but was crying at intervals. Temperature was 100°F., pulse 152, respirations 40 per minute. The skin was wrinkled and dry. The anterior fontanelle was open and soft, the posterior one closed. The abdomen showed slight distention and some tympany, but no rigidity. In the right inguinal region was a rounded, soft mass, not reducible on pressure. The lower portion of the mass was firm, and about the size of a testicle. No testis could be palpated in the right side of the scrotum. The left testis could be easily moved up to the inguinal ring and down into the scrotum. An enema obtained only a small amount of thin yellow stool.

In this case, strangulated hernia could not be ruled out as a diagnosis. Under ether anesthesia, operation was performed two hours after the baby entered the hospital. The mass in the right inguinal region was found to be a sac of peritoneum, bulging through the external inguinal ring, and containing a small knuckle of ileum as well as the testis. A small amount of serous fluid was present in the sac. The strangulated portion of intestine was reddened, but not gangrenous, but the testis was black and quite firm. The vas was enlarged, dark in color, and twisted. It was impossible to reduce the hernia until the external inguinal ring had been enlarged by incision of the external oblique

fascia. It was necessary to excise testis and cord, after reducing the hernia. The ring was closed with chromic catgut, and the wound closed without drainage.

On the following day, the baby's temperature dropped to normal, and convalescence was rapid. No vomiting occurred. One hour after operation, beta-lactose feedings were begun, and the following day a formula of milk was given. On November 1, the tenth postoperative day, the baby was taken home, in good condition.

SUMMARY

1. Torsion of the spermatic cord is rather uncommon.

2. This condition should be suspected in the presence of any acutely painful mass in the inguinal region, more particularly when cryptorchidism is found.

3. Two cases of torsion of the cord are reported, occurring in brothers aged fifteen months and four weeks respectively, both having cryptorchidism as an etiologic factor.

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MAMMOGRAPHY

SOFT TISSUE TECHNIQUE

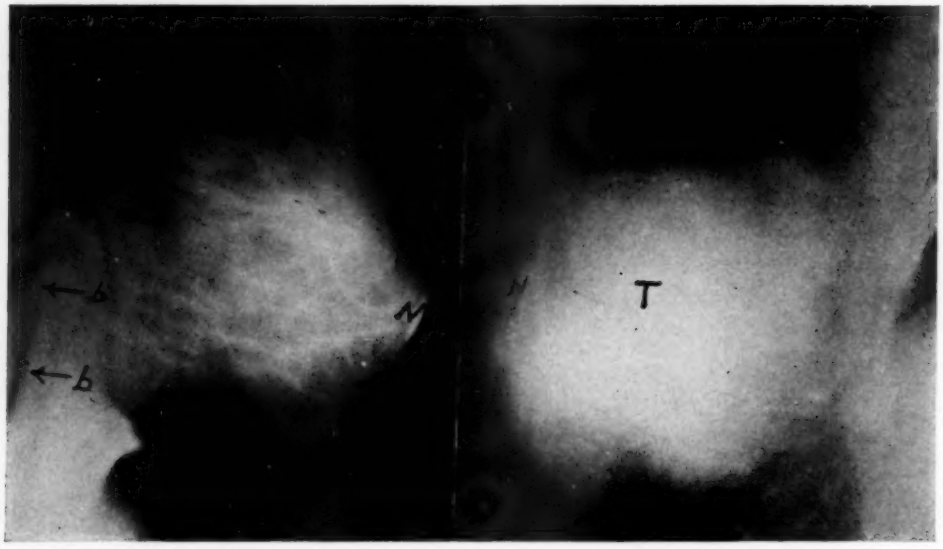
LEWIS J. FRIEDMAN, M.D. AND CHARLES SLATER, M.D.

Director, Roentgen Ray Department, Bellevue Hospital

Resident, Roentgen Ray Department, Bellevue Hospital

NEW YORK CITY

ALTHOUGH the literature is replete with monographs on the Roentgen-ray variations of the normal and pathologic breast, more recent contributions indicate that the last word has probably not as yet been written.



A B

FIG. 1. A, normal and B, pathologic breasts of a female, age 44. N, nipple; *b*, the submammary clear space; T, malignant tumor. (See Fig. 2.)

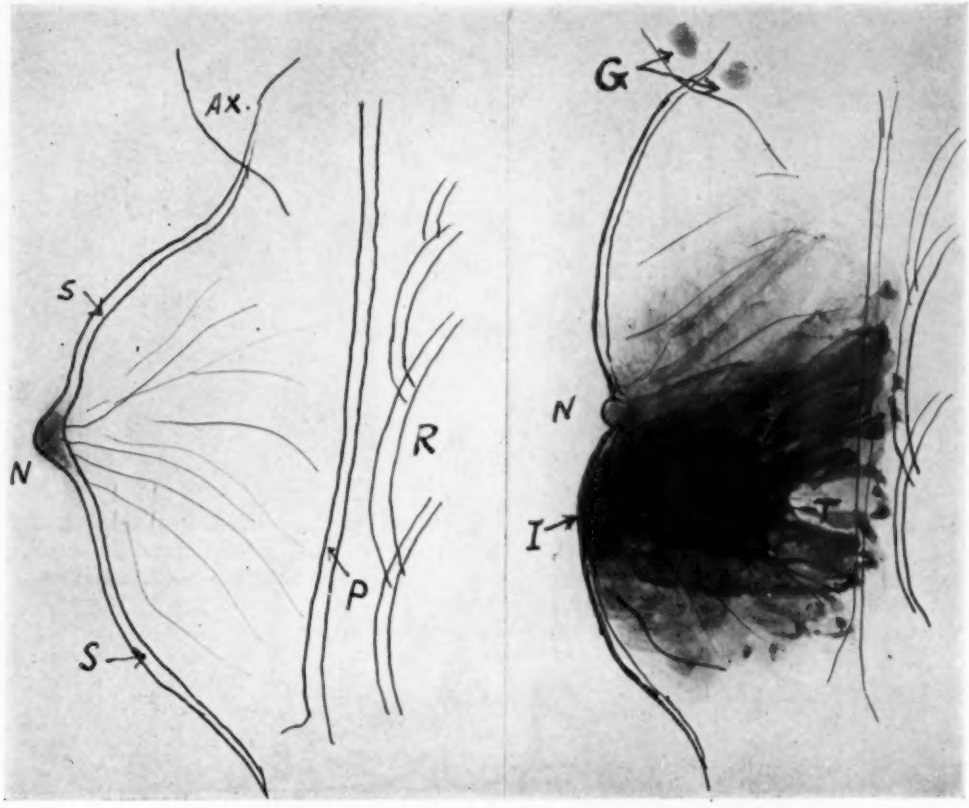
It must be conceded, however, that while the radiographic procedure is comparatively simple, the absolute classification of the silhouetted lesions on a histologic basis is often fraught with difficulties and pitfalls. Careful correlation of the Roentgen findings with the clinical manifestations is usually essential in diagnosis.

Recently, Hicken[1] and others[2,3] demonstrated the use of opaque contrast media into the lactiferous ducts, and aeromammography to localize and identify pathologic lesions. Since it is obvious that these supplemental diagnostic procedures entail some inconvenience to the patient, the cases in which these techniques are indicated must be carefully chosen. We must hastily add that there is no intent to minimize the value of these important contributions in the examination of the breasts. On the contrary, we wish to emphasize that for the recognition of small papillomata within the milk ducts, the injection of opaque media cannot be dispensed with. It must be stressed, however, that soft tissue radiography alone will reveal, in a large percentage of instances, the location and effect of the pathologic process within the breast. According to Gershon-Cohen[4] and from our own observation, the high percentage of accurate Roentgen findings that were confirmed by histologic studies of the tissues is indeed reassuring.

It may be repeated here that the changes in the pattern of the breast may be either

physiologic or pathologic. The former designation comprises the alterations incident to menstruation, pregnancy (Fig. 3) or

3. Does the pathologic process infiltrate the subareolar and subcutaneous tissues? Cellular induration incident to a breast



A B

Fig. 2. Diagrammatic representation of radiographs of A, normal, and B, infiltrated gland. AX, axilla; S, subcutaneous clear space; N, nipple; P, posterior clear space; R, ribs. G, enlarged and dense lymph nodes; N, retracted nipple; I, infiltrated and obscured subcutaneous space and posterior clear space; T, tumor.

menopause (mazoplasia); the pathologic process may be inflammatory (Fig. 7) or neoplastic. (Fig. 6.) The latter again may be benign (Figs. 4 and 5) or malignant in character.

In the evaluation of the Roentgen findings the following basic factors must be considered for diagnostic significance.

1. Is there a well defined mass? Circumscription usually indicates a benign lesion. A calcified mass is invariably benign. (Fig. 4.)

2. Is there retraction of the nipple? While most commonly present in malignant lesions, an inflammatory process or anomalous condition may also reveal distortion and retraction of the nipple.

abscess may simulate the invasive changes of carcinoma. The clinical data are important.

4. Is the clear space at the base of the breast obscured? Only malignancy can obliterate this area by invasion, since all inflammatory processes occupy the anterior region of the gland.

5. Are there any enlarged or calcified nodes in the axilla? Enlarged non-calcified nodes would most likely indicate the presence of a malignant breast lesion.

It must be stressed that both breasts be radiographed for comparative purposes. It is obviously evident that the small hypoplastic breast or that of the male does not lend itself to this method of examination.

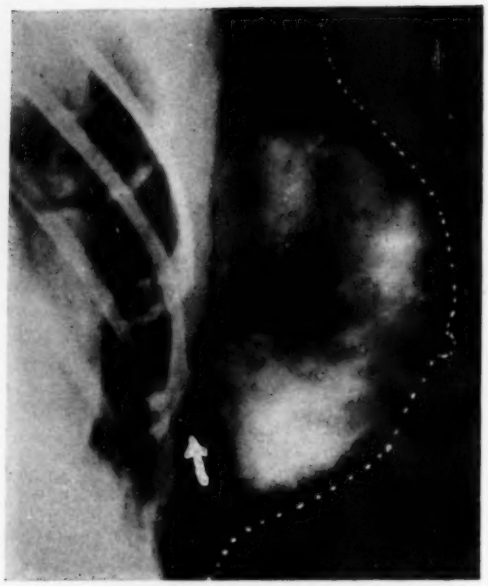
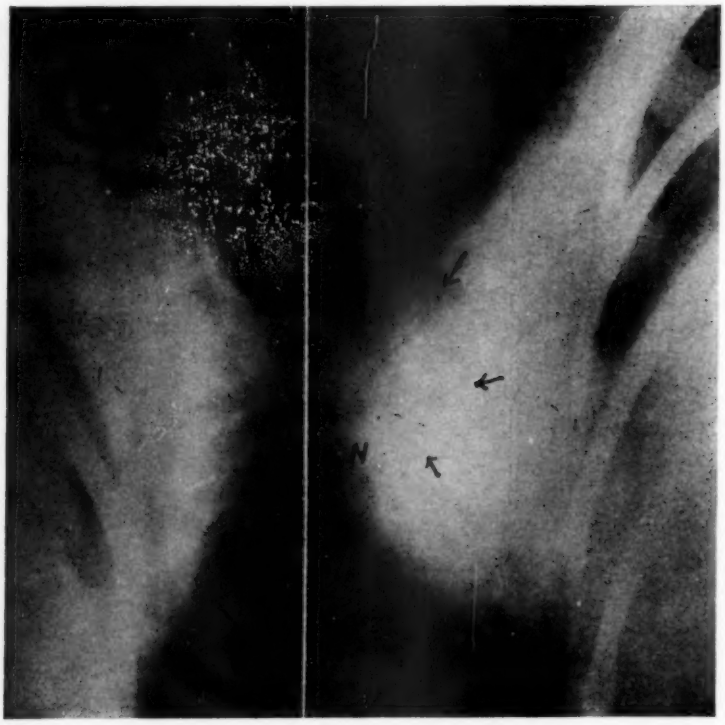


FIG. 3. Breast of a woman in the fourth month of pregnancy. Arrow indicates the clear space at base of breast. Note loss of normal architecture as compared with Figure 1A.

FIG. 4. Pendulous normal breast containing two calcified masses.



A B

FIG. 5. Breasts of a 16 year old female. A, normal breast during menstruation showing rather dense striations converging toward a slightly retracted nipple. B, enlarged breast due to a benign tumor indicated by arrows. N, retracted nipple.

CASE REPORTS

Case I. J. E., female, age 50, was admitted to the ward with a diagnosis of hypertension and chronic nephritis. Routine physical examination revealed several painless firm nodules in the left breast. These were freely movable and not adherent to the skin.

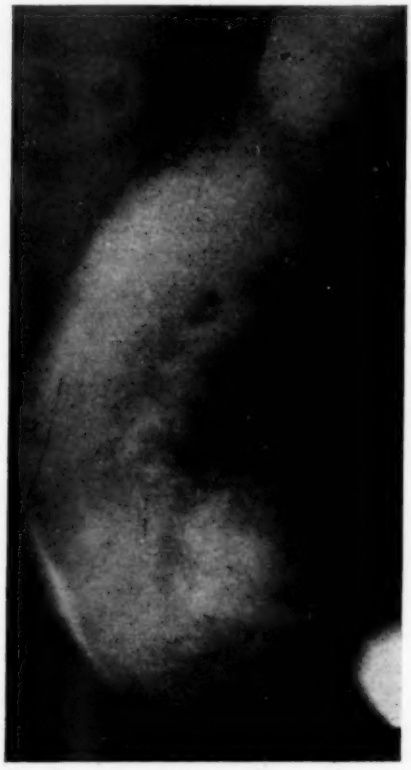


Fig. 6. Breast with a malignant growth indicated by arrows and c's; s, infiltrated subcutaneous tissues.

Roentgen Finding. There were two discrete, fairly smooth, calcified nodules in the lower hemisphere of the left breast. The ducts were visualized and appeared normal. (Fig. 4.) No surgical intervention was attempted.

Case II. E. Mc., female, age 16. The patient had noticed swelling of the left breast one year before admission to hospital; the mass grew insidiously. The swelling was painful only at rare intervals. There was no history of trauma; no serous or sanguineous discharge.

Physical examination showed a fairly well circumscribed mass about 4 cm. in diameter situated in the left upper quadrant of the left breast. The nipple was slightly retracted, but there was no fixation of the skin over the tumor. There were no axillary or supraclavicular nodes palpable. Examination of the right breast also showed a slightly retracted nipple.

Roentgen study indicated a degree of hyperplasia incident to menstruation in both breasts. There was a well circumscribed, fairly dense mass at the level of and above the nipple. Both nipples were somewhat retracted. The subcutaneous tissues surrounding the gland were free. (Fig. 5.)

Fig. 7. Breast abscess. Arrows indicate indurated subcutaneous tissue and retracted nipple.

At operation, a mass the size of an orange was removed, which presented on section a dense, homogeneous architecture. Histologic study disclosed an intracanalicular adenofibroma with no evidence of malignancy.

Case III. N. M., female, age 44, was admitted to the hospital with a mass in the left breast which she first noticed three weeks before admission.

Physical examination revealed a movable painless tumor (nodular and firm) in the left breast. There was no retraction of the nipple or skin, but several palpable nodes were felt in the axilla.

On *x*-ray, a moderately opaque area was seen in the mid-portion of the lower half of the left breast, measuring about 5 cm. in diameter. Infiltrating strands extended upwards. The subareolar tissue appeared to be infiltrated. (Fig. 6.)

Radical mastectomy was done and biopsy revealed a duct cell carcinoma.

Comment. Although the retraction of the nipple contributed a conjuring element in Case II, the circumscription of the tumor, the homogeneous density of the mass, and the lack of invasion of the subcutaneous tissues in Case II favored the diagnosis of a benign tumor and a malignant tumor in Case III. The retraction of the nipple in Case II was anomalous, since the deformity existed also in the normal breast.

Case IV. C. N., female, age 37, was admitted to the hospital because of a painful right breast. She recalled that she had injured the gland some four weeks before. Two weeks prior to admission, the patient noticed a slight watery discharge from the nipple. Gradually she began to experience pain of a "pulling and itching" character below the nipple, and the area became hard and reddened.

Physical examination of the breast revealed slight retraction of the nipple, and an area of redness about 1.5 cm. in diameter in the lower and outer quadrant of the gland; the induration felt hot to touch and pitted slightly on pressure. A central area of fluctuation was also evident.

The Roentgen study (Fig. 7) revealed an irregular, hazy and moderate radiopaque area in the lower half of the breast extending to the subareolar tissue below the nipple which appeared slightly retracted.

Incision evacuated a sanguineous and purulent discharge. Recovery was uneventful.

Comment. Although from a Roentgen point of view the retraction of the nipple and the apparent infiltration simulated a neoplastic process, the clinical manifestations definitely ruled out a neoplasm as the cause.

CONCLUSION

Several cases are presented to illustrate the feasibility of *x*-ray diagnosis by simple soft tissue radiography. The clinical findings must, as a rule, be considered. The most important indication of *malignancy* of the breast is the *infiltration* of the subareolar or subcutaneous tissue of the gland.

The nipple may be retracted or otherwise displaced by a benign lesion such as an abscess, or as an anomalous process which is invariably bilateral.

The more recent methods of examination should be invoked when the simple soft tissue technique is inconclusive.

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INTUSSUSCEPTION IN THE ADULT

GEORGE WEBB, M.D. AND WILLIAM SHEINFELD, M.D.

Attending Surgeon, Coney Island Hospital; Chief Surgeon, Madison Park Hospital

Assistant Attending Surgeon, Coney Island and Trinity Hospitals

BROOKLYN, NEW YORK

INTUSSUSCEPTION in the adult is a most interesting and perplexing surgical problem. Seldom do we find so many different etiologic factors causing the same clinical picture. It is amazing that embryologic defects or variations, simple derangements of intestinal physiology, infectious diseases, neoplastic diseases both benign and malignant, primary in the gut or metastatic, or previous operative procedure (gastroenterostomy) may all produce the same clinical symptom complex, dramatic in its inception and in its subsequent course.

Four cases of our own serve to illustrate these facts, each case representing a separate etiologic group. Touching on other illustrative cases reported in the literature, we will construct a representative, though sketchy picture of intussusception in the adult.

CASE 1. (G. S., #59435.) The patient, an adult white male, 62 years of age, was admitted to the Third Surgical Service of the Coney Island Hospital. He gave a three to four month history of gradual, slightly increasing constipation with an occasional diarrheal movement without blood. For the previous week there had been occasional attacks of left-sided colicky abdominal pain. There was no loss of weight or anemia.

Physical examination was essentially negative except for the presence of a mass in the rectum, just palpable at the end of the finger. The exact nature of this mass could not be determined by digital examination. Past history and family history were irrelevant.

On proctoscopic examination the day after admission, only normal rectal mucosa could be seen, but the proctoscope was obstructed at 9 cm. by apparently normal mucosa. A biopsy of the palpable rectal neoplasm could, therefore, not be obtained. On the day following proctoscopic examination, the patient was seized with severe, generalized, colicky abdominal pain, had intense desire to defecate, but could not even pass gas. Attempts to pass a rectal tube beyond the obstructing mass were unsuccessful. The abdomen was moderately distended and there was visible peristalsis present. Because of the sudden onset of acute obstruction, immediate laparotomy was performed (W. S.) under spinal anesthesia.

Operative Findings. The entire large gut was distended down to the point of a sigmoidal invagination into the rectum (Fig. 1), forming a mass about 6 inches long in the depths of the pelvis. This intussusception was easily reduced by milking the invaginated gut up from below. At the apex of the intussuscipiens, a hard, infiltrating mass was palpable. This mass completely girdled the sigmoid. The mesentery of the sigmoid was somewhat longer than that usually encountered. The tumor and several inches of normal gut on either side were exteriorized (first stage Mikulicz). As the tumor itself did not cause obstruction, the gut was not opened until the second stage was done. The obstruction was completely relieved following the reduction of the intussusception and four days later the exteriorized gut was amputated and a double barrel colostomy established. The intervening spur was subsequently obliterated and the remaining single barrel colostomy closed. The wound healed per primam.

Pathologist's report by Dr. H. Fink was: adenocarcinoma of the sigmoid; infiltrative. (Fig. 2.)

The patient was seen one year following his discharge from the hospital. He was perfectly well, had gained weight and was back at work.

The usual features of tumor associated with intussusception were missing. The lesion was not pedunculated, but infiltrative, and the ordinary picture caused by this lesion is a constrictive intestinal obstruction.

Of the 300 cases of intussusception in the adult reviewed by Elliot and Coras-

caden,[1] only forty were associated with intestinal malignancies, and of those only five were in the sigmoid. Recently Salvin[2] eighteen sigmoidal invaginations were presented. Mention should be made of cases reported by P. Laurent.[6] Though the

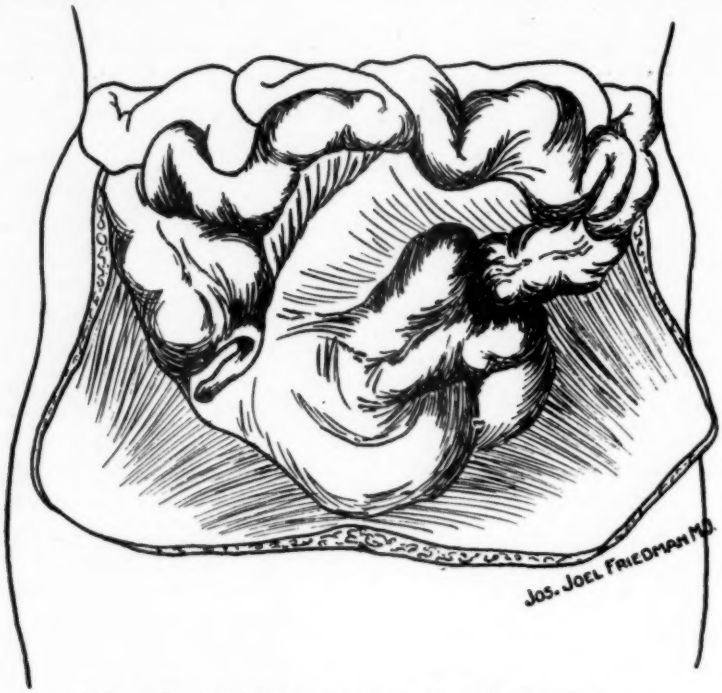

Fig. 1. Sketch of lesion in situ as found at operation.

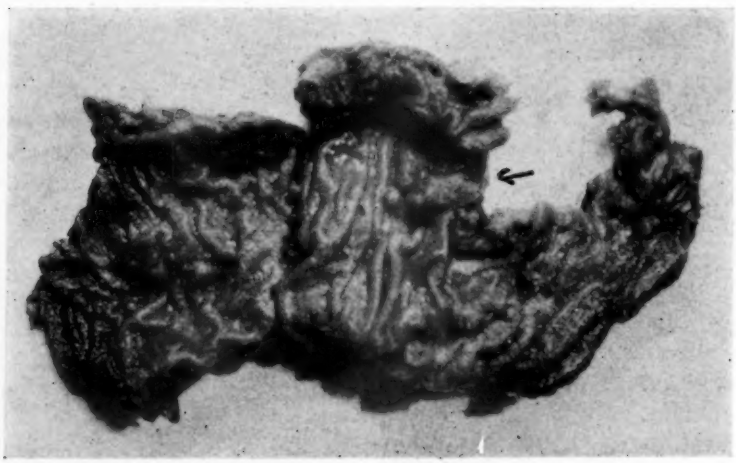

Fig. 2. Specimen showing infiltrating carcinoma of sigmoid (Case 1).

reported a case of sigmoidal-rectal intussusception in a woman of 60, but here the tumor was a papillary adenocarcinoma of the sigmoid. E. N. MacDermott[3] cites two cases of intussusception secondary to malignancy in the sigmoid. In 1907, Coffey[4] published a carcinoma of the sigmoid flexure where intussusception had occurred. In Gueulette's[5] series of 123 collected cases, picture is not a rare one, nevertheless, it is extremely uncommon when the tumor is not pedunculated, as described above.

Case II. (D. M. C., #53299.) The patient was a young man in his late twenties. Several years prior to his present admission to the hospital, a pigmented skin tumor of the back, of small size, was removed. Details of this procedure were not available. About two months

before admission, bilateral cervical adenopathy was noted. A blood count was interpreted as suggestive of Hodgkin's disease. Radiotherapy was administered and there was a moderate resolution of the cervical swellings. Two days before admission, there was a sudden onset of generalized, colicky, abdominal pain, most marked about the peri-umbilical region. Several episodes of vomiting occurred. Repeated enemas, though at first provoking a normal looking stool, gave no relief.

On his admission to the hospital (Third Surgical Service) it was obvious that the patient was suffering from intestinal obstruction, the cause of which was not immediately determined. Intravenous fluids and gastric lavage were administered. Two enemas were ineffectual. Exploration (W. S.) was undertaken shortly after admission. On opening the peritoneal cavity, we encountered a moderate amount of free, coal black peritoneal fluid. The entire greater omentum was similarly black and thickened to about twice its normal size. The proximal ileum was dilated; the distal ileum was collapsed. In the middle of the ileum, an intussusception about 3 inches long was encountered, and easily reduced. At its apex, there was a small umbilicated, infiltrative, nodular growth, the diameter of a dime, intrinsic in the ileal wall. In the terminal ileum a second intussusception about a foot long was seen. Here, too, near the apex of the intussusception, an umbilicated, infiltrative lesion, twice the size of the first one, was clearly visible from the serosal surface. The intussusception was easily reduced and the growth and adjacent loops of gut exteriorized. Numerous similar growths were present in other portions of the small gut. They did not, however, cause any obstruction of the lumen of the bowel.

The patient succumbed quite suddenly following a satisfactory postoperative convalescence. Pathologic examination of a biopsy of the omentum and the exteriorized tumor was: Melanoma, malignant, metastatic in nature.

This is an instance of double intussusception, secondary to metastatic malignancy. None of the tumors was pedunculated.

A similar case of acute intussusception in an adult due to metastatic melanotic sarcoma was reported by Cuff and Gosden[7] in 1935.

Case III. (Pioneer Hospital, Lahaina, Hawaii.) A Hawaiian man, 40 years old, was admitted to the surgical ward of the hospital complaining of bloody diarrhea of four days' duration and cramp-like pain in the right half of the abdomen. Vomiting had occurred during the past twenty-four hours of the disease.

Examination of the patient showed a well nourished man. The abdomen was markedly distended with definite muscular spasm in the region of the right rectus muscle. The left side of the abdomen was soft, though tender on palpation. The tongue was dry, the temperature 102, pulse 120, respirations 30. Urine examination proved negative. Blood hemoglobin was 75 per cent; the red blood cells, 4,000,000; white blood cells, 14,000; polymorphonuclears, 82 per cent.

Under spinal anesthesia, immediate exploration was undertaken and an extensive invagination of the ileum into the cecum was observed. This invagination extended to the middle of the transverse colon and had caused considerable edema of the entire ascending colon. The intussusception was reduced with difficulty and the abdomen closed without drainage. The condition of the patient improved rapidly within the next three or four days and he was receiving additional nutrition when a second attack of pain occurred. The previous picture reëstablished itself and the patient was reoperated on the sixth postoperative day. A similar intussusception of the ileum was found, though not as extensive as before. This was reduced, but the patient expired suddenly the same night. Autopsy was refused. No tumor was palpated. This was one of idiopathic intussusception in an adult.

Case IV. Mrs. C. H., white, 34 years old, was admitted to the Coney Island Hospital with the complaint of subsiding pain in the right lower quadrant of three days' duration, accompanied by nausea, vomiting and constipation.

For the past ten years, the patient had complained of a dull ache in the right lower quadrant, increasing on violent exercise and at night when lying on her side. Occasionally this pain had been referred to the epigastrium and was then accompanied by nausea. She had always been somewhat constipated and had passed several blood-streaked stools within the past six months. Her appetite had always been good and her weight constant. Her marital and menstrual histories were negative. Three days prior to admission to the hospital, the patient experienced a severe pain in the right lower quadrant, and vomited once. Her temperature remained normal and her bowels moved twice

that day. The stool was liquid, but free of blood. Toward the evening of the same day, the vomiting recurred, the pain increased and became cramp-like in character. A physician diagnosed an attack of acute appendicitis and ordered opiates and an ice bag. Next day, she felt considerably improved. The stool was normal, but the pain in the lower abdomen persisted all day. On the morning of the third day, operation for subsiding appendicitis was advised by the attending physician, whereupon the patient was admitted to the Coney Island Hospital.

She was found to be suffering considerable pain. The right lower extremity was held flexed. The head and the chest were negative. The abdomen was soft except for the right lower quadrant, where there was a pronounced muscle spasm on palpation. The suprapubic area was soft and painless, whereas there was marked tenderness over McBurney's point. There was an indefinite mass palpable at this point, which could not be outlined satisfactorily because of muscle spasm. Pelvic examination was negative. There was no vaginal discharge. Temperature, pulse and respiration were normal as were the laboratory findings. The white blood count was 11,000 with normal differential. A preoperative diagnosis of subsiding acute appendicitis was made.

At operation (G. W.), the cecum was found glued to the parietal peritoneum and contained a mass about the size of a tangerine within its lumen. This mass did not pit on pressure, was elastic and firmly attached to the posterior aspect of the cecum, whereas the anterior wall of the cecum could be freely moved over the surface of the tumor. The ileocecal region was slightly invaginated into the ascending colon and was edematous. The appendix was normal in size, color and position. There were no periappendiceal adhesions. Upon recognition of the tumor in the intestine, the ileum was clamped off 8 cm. from the ileocecal junction. The cecum was mobilized by incising the peritoneum in the lateral lumbar gutter, and was clamped well above the tumor mass. Both bowel ends were closed with three layers of catgut sutures and an isoperistaltic anastomosis was done. The abdomen was then closed without drainage.

The pathologist reported the tumor as a simple lipoma, submucous, having an area of necrosis about the size of a silver dollar on its free surface inside the lumen of the cecum. The convalescence was entirely uneventful and at reëxamination six months later, the patient was entirely free of abdominal symptoms.

This case represents the group of intussusception secondary to benign growths, usually lipomas or fibromas of the iliocecal region.

Reference is made to the papers of Dewitt Stetten,[8] and Clifton and Landry,[9] for a complete description and review of intestinal tumors, benign in nature, and their rôle in the causation of intussusception. Case reports of this type of adult intussusception due to tumors are most frequent of all in the literature.

Congenital Cases.[1,10,11,12,13] Meckel's diverticulum, occasionally with a tumor in the diverticulum, more often unassociated with tumor, has frequently been found in cases of intussusception in the adult. The base of the diverticulum is usually broad. A number of such cases has been reported and reviewed.[14]

Congenital tumors may be the cause. Of special interest in this type are those cases where an accessory pancreas is the tumor in the wall of the gut.[15] These have been reported in the stomach, duodenum, jejunum and occasionally in the ileum. The clinical picture is one of high intestinal obstruction.

E. V. Thies[14] reports an enterocystoma causing an ileocecal intussusception and reviews the literature.

A number of cases has been reported complicating typhoid fever.[16] These occurred mostly from the thirty-fifth to the fortieth day of the disease, but varied in incidence from the first to the seventh week. Though uncommon, intussusception complicating typhoid must be remembered in considering the acute abdomen that may complicate the picture.

Intussusception has also been reported in tuberculosis of the intestines and occasionally with specific enteric disease such as dysentery and cholera. An extremely dramatic form of intussusception may occur following gastroenterostomy.[13,17,18,19,20,21] Two varieties exist: (1) true, retrograde jejunal intussusception into the stomach; and (2) herniation of the small gut through

the stoma into the stomach. This variety is not true intussusception, but has been considered as such. Such a complication presents a picture of a high intestinal obstruction and usually a mass is palpable in the epigastrium. Early operation yields excellent results. Late operation is attended with a high mortality.

Two cases occurring after prolonged fast are reported by A. W. Morro.[22] One occurred in an adult of 40, who drank a glass of cold water following a sixteen hour fast. This was followed by a sudden onset of severe abdominal pain. Four days later, operation revealed a late ileocolic intussusception. The second case occurred in a man of 50, who was stricken similarly while merely contemplating food after a sixteen hour fast. Here, too, five days later, a late ileocolic intussusception was encountered.

CONCLUSION

We have presented four cases of intussusception in adults representing four different etiologic factors and have briefly mentioned a variety of circumstances under which this type of surgical abdomen may be encountered. Realization of the possibilities and knowledge of these will unquestionably lead to more widespread preoperative recognition or suspicion of this disease with earlier operative intervention and an unquestionable reduction in the attendant mortality.

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POSTOPERATIVE SLOUGH FOLLOWING AMPUTATION FOR CRUSHING LEG INJURIES

DONALD W. HEDRICK, M.D. AND CHARLES F. MONTGOMERY, M.D.

Associate Surgeon, Division of Orthopedic Surgery, Henry Ford Hospital

DETROIT, MICHIGAN

CRUSHING injuries to the extremities have increased proportionately with the degree of mechanization in industry and commerce. Some of these extremities require immediate amputation as a life-saving measure. The type and site of amputation are problems for the attending surgeon.

Four such cases are reported here, not with the idea of drawing conclusions from so small a series, but because of the similarity of injuries, course, complications, and results. Amputation was done in each case shortly after admission to the hospital. The site of amputation was at or near the junction of the upper and middle thirds of the leg. Closure with drainage for forty-eight hours was done immediately in all cases. Each case developed a postoperative slough of the flap margins, which included only skin and subcutaneous tissue. All cases required later surgery, such as skin grafting or reamputation.

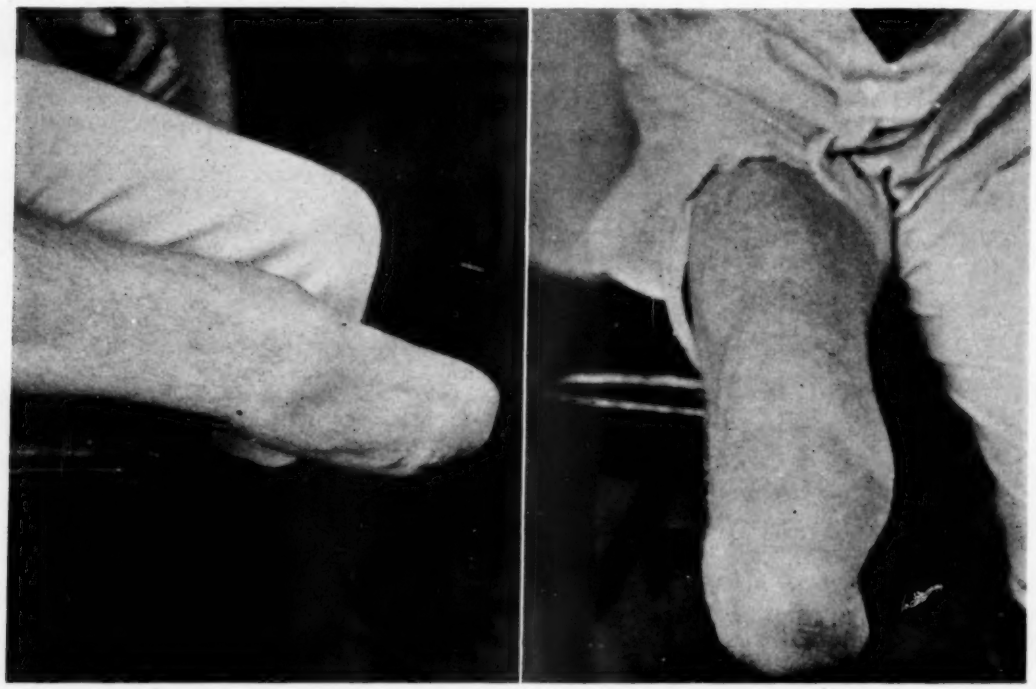

FIG. 1. Case 1. End result two years after injury. Good functional stump.

CASE REPORTS

CASE 1. T. E. (#207367), a white male, age 30, was admitted to the Henry Ford Hospital on November 3, 1934 following a crushing injury to the right leg and foot. He was in profound shock, for which he received the usual treatment. As soon as his condition warranted, the right leg was amputated at the junction of the middle and upper thirds. The skin flaps were closed without tension. Following amputation, adhesive traction was applied to the stump.

At the time of the second dressing on November 7, 1934, there was an area on the medial aspect of the stump which showed evidence of inadequate blood supply. The skin and subcutaneous tissue in this area later sloughed. There was never any evidence of gross infection. The defect promptly filled in with granulation tissue and on January 7, 1935, a Reverdin skin graft was applied. The patient was discharged from the hospital on January 23 with the stump healed.

He started wearing a temporary prosthesis March 5, 1935. On May 29, 1935, a painful scar was excised and on August 26, a reamputation was performed. The patient's convalescence was uneventful and he has had no further difficulty with the stump.

Case II. E. R. (#230852), a white male, age 25, was admitted to the Henry Ford Hospital on February 23, 1936, with a crushing injury of the right leg resulting from a fall beneath a moving train. A tourniquet had been in place continuously for four hours prior to admission. He was treated for mild shock and the right leg amputated at the junction of the upper and middle thirds. The muscle flaps were closed without difficulty and the skin flaps closed under moderate tension. Adhesive traction was applied to the stump.

At the first dressing on March 25, 1936, there was evidence of beginning gangrene in the posterior flap. The defect from the slough granulated in satisfactorily and on April 1, 1936, a plastic resection of the stump was performed. The skin flaps were closed without tension. The stump subsequently required a

Fig. 2. Case III. Six weeks after injury.

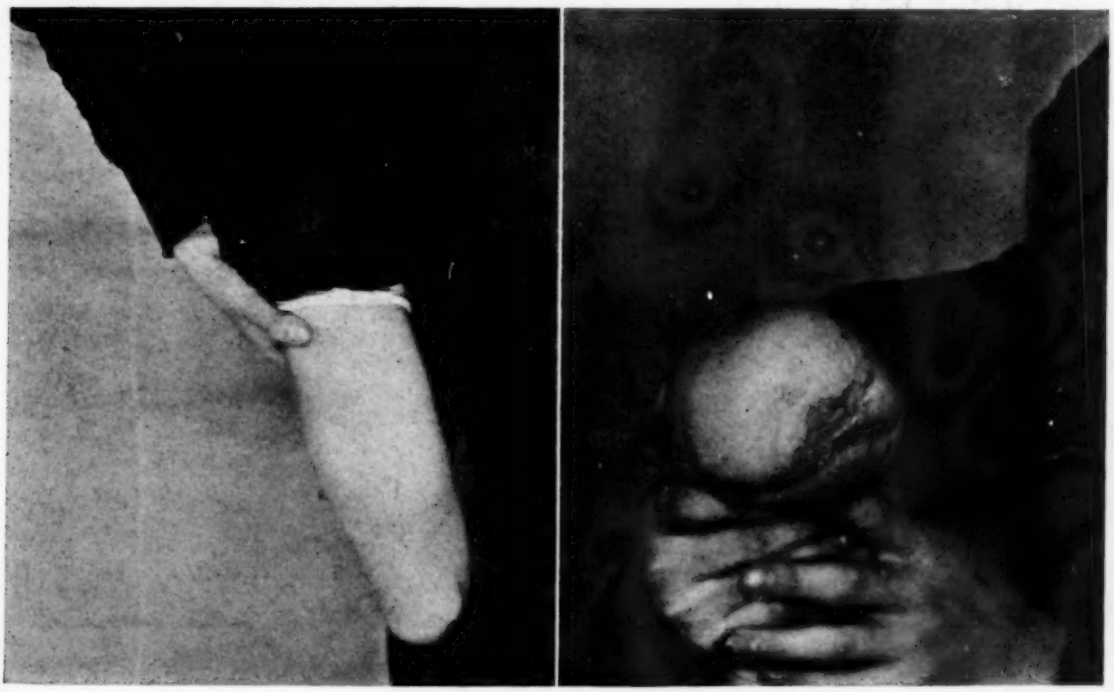

Fig. 3. Case III. Eight weeks after injury.

Reverdin skin graft to a granulating area which followed a second slough in the posterior skin flap. The patient was discharged from the hospital on May 4, 1936. The stump was entirely healed. It was necessary to excise a painful scar in the stump on July 20, 1936, but the patient has since had a satisfactory weight-bearing stump.

Fig. 4. Case iv. Two and one-half weeks after injury.

Case iii. S. J. (#224241), a white male, age 15, was admitted to the Henry Ford Hospital on November 3, 1936, with a crushing injury to the right foot and ankle, resulting from a fall beneath a moving train. A tourniquet had been in place continuously for three hours prior to the time seen. He was treated for moderate shock. As soon as his condition would permit, the right leg was amputated at the site of election. The muscle and skin flaps were closed without tension. No traction was applied.

On November 10, 1936, it was noted that the skin edges were black along the medial aspect of the incision. On November 21, there was a slough of three-quarters of an inch of the anterior flap. Following brine baths, the defect from the slough filled in rapidly. A Reverdin skin graft was applied on December 17, and the patient discharged from the hospital on December 24. The stump was healed on Jan. 21, 1937. In April 1937, the patient was wearing a temporary prosthesis.

Fig. 5. Case iv. Four weeks after injury.

Case iv. A. D. (#246422), a white male, age 51, was admitted to the Henry Ford Hospital on December 15, 1936, with a crushing

injury to the right foot, resulting from a fall beneath a train. A tourniquet had been in place continuously for three hours. There was no evidence of shock and the right leg was immediately amputated at the site of election.

TABLE I

Case	Age	Injury	Shock	Length of Time Tourniquet on before Admission, Hours	Time between Injury and Amputation, Hours	Point of Amputation	Skin Traction	Skin Graft	Secondary Operations	Period of Hosp., Days	Elapsed Period before Prosthesis Applied, Days
T. E. #207367	30	Crushing injury to rt. leg and foot	Profound	3	4	Junction upper and middle third	Yes	Yes	Reamputation	81	122
E. R. #230852	25	Crushing injury to rt. leg from train	Mild	4	6	Junction upper and middle third	Yes	Yes	Plastic resection of stump	71	263
S. J. #224241	15	Crushing injury to rt. foot and leg from train	Moderate	3	6	Site of election	No	Yes	No	51	177
A. D. #246422	51	Crushing injury to rt. foot from train	None	3	3½	Site of election	No	Yes	No	44	142

The muscle and skin flaps were closed without tension. Traction was not applied to the stump.

On the fourth postoperative day, the skin over the medial portion of the stump was gangrenous. Brine baths were given to the stump and the defect granulated in sufficiently for a Reverdin skin graft to be applied on January 18, 1937. Patient was discharged from the hospital on January 28. On March 25, 1937, the stump was healed and by May 6, he was wearing a prosthesis.

COMMENT

Postoperative gangrene of the skin has been described by Meleney, Ballin and others. It is seen chiefly following abdominal surgery, especially for appendicitis. It has been claimed that the process is infectious and the result of a synergistic symbiosis of two or more common organisms.

The cases presented in this paper, however, did not follow the course described by authors reporting slough of abdominal skin. The progress was not as rapid nor were the stumps resistant to treatment. In none of these cases was there evidence of peripheral vascular disease.

The following are presented as possible contributing factors in the slough which developed in the cases reported:

1. In each case the flaps were made of apparently healthy skin without evidence of severe trauma. They bled readily at the time of amputation. In spite of this it is conceivable that trauma to the soft parts of the extremity may have been more

extensive than realized at the time of operation.

2. The middle and lower portions of the leg have notoriously poor blood supply in the skin, especially along the anterior and medial aspects.

3. If shock is profound or prolonged, the peripheral circulation may be diminished to a point at which nutrition of the dissected flaps is impaired.

4. It is impossible to control the length of time a tourniquet has been in place previous to admission to the emergency room. This factor would seem to be most important.

If the entire extremity has been severely traumatized, it may seem advisable to do a guillotine amputation, or better, a flap amputation, leaving the wound open for later closure or reamputation after the circulation has had an opportunity to be reëstablished. Such a procedure would minimize the degree of swelling in the stump, and as a result of the open drainage provided, there would be no increased tension placed on the flaps because of accumulated autolysed tissue.

SUMMARY

One of the problems of present day traumatic surgery is described. Slough of the flaps following amputation for crushing leg injuries is seen not infrequently. Contributing factors are presented and discussed. Four typical cases are reviewed.

THE acquisition of an *x*-ray machine by the large city practitioner is of doubtful advisability as far as the welfare of his patients is concerned. From—"The Roentgenologist in Court" by Samuel Wright Donaldson (Thomas).

NEW INSTRUMENTS

A SIMPLE INEXPENSIVE COLOSTOMY BAG

LEO M. LEVI, M.D.

PASADENA, CALIFORNIA

DESPITE the great variety of colostomy bags available, the author sought to develop an inexpensive colostomy bag which would be both light in weight and easy to keep clean, and has found useful the appliance to be described:

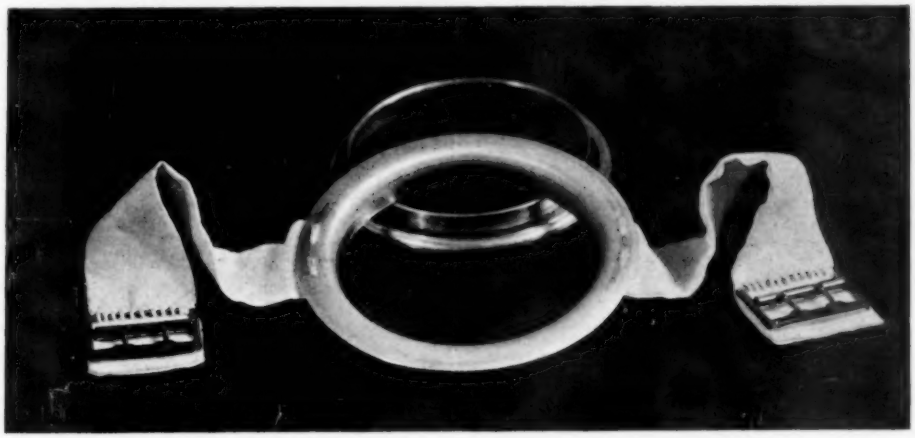

FIG. 1.

Two rings are spun from 1/16 inch (20 gauge) soft sheet aluminum. (Fig. 1.) One ring fits loosely inside the other in the manner of an embroidery hoop. The size of the rings is governed by the type of the patient's colostomy. A double barreled colostomy with the two loops somewhat widely spaced will obviously require a larger aperture than a single barreled one. For the latter the measurements which we employ are an outside diameter of the larger ring of 3½ inches, with an inside diameter of 2¾ inches. The smaller ring has an outside diameter of 3 inches and an inside diameter of 2⅜ inches. A circle of rubber dam or thin rubber sheeting with a diameter of approximately 12 inches is placed across the inner surface of the larger ring. The center of this sheet is depressed and drawn through to form a pouch. The smaller ring is then fitted over the larger and into this bag (Fig. 2) there is placed a sheet of cellucotton or similar absorbent and easily disposable material. There should be an ample amount of this material used so that it protrudes beyond the margins of the innermost ring and lies next to the skin. Several small holes are drilled through opposite sides of the larger ring, permitting a muslin band to be stitched to each side of it. Buckles are sewed on the muslin and elastic of suitable width is attached by means of these buckles. This elastic should be just long enough to fit snugly about the body.

Additional perforations are also drilled in the rim of the smaller ring, for it has been found that in obese patients the pressure of the ring next to the body is sometimes annoying, and in such cases a semi-

circular wedge of sponge rubber can be stitched to the ring in order to cushion it from the body. For cleaning purposes, all that is usually necessary is to remove the absorbent tissue, which is easily disposed of, and place fresh tissue inside the rubber pouch. Should the rubber itself become soiled, it is easily replaced and can be boiled if necessary.

It is possible to have these rings made by any aluminum spinning company and together with the necessary muslin, rubber, elastic and buckles, the total cost should be under one dollar.

Fig. 2.

PAPILLATOME

GEORGE I. ISRAEL, M.D.

Proctologist, National Stomach Hospital; Assistant Proctologist, Jewish Hospital; Instructor in Anatomy, Jefferson Medical College

PHILADELPHIA, PENNSYLVANIA

THE instrument here described is for use in removing hypertrophied anal papillae and renders such an operation a simple and surgically clean office procedure.

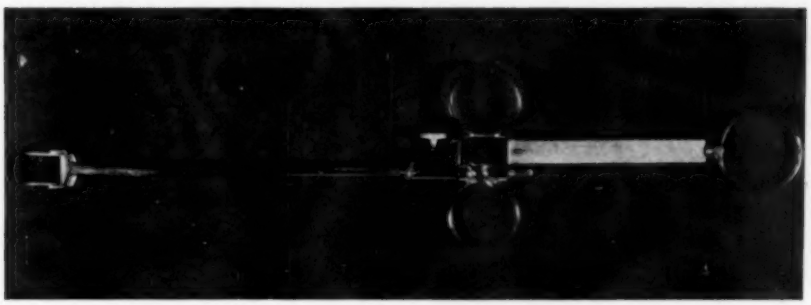

FIG. 1.

If the occasion arises after a hemorrhoidectomy to remove an isolated overgrown papilla, the amount of pain caused in its removal with this instrument is less than that which would follow a local injection of novocaine into the papilla.

If more than one papilla is to be removed, anesthesia may be obtained by either topical anesthetic lubricant, direct injection of the local anesthetic into the papilla, or circumanal quadrant injection of the local anesthetic.

This papillatome is a modified Myles lingual tonsillotome with its guillotine three-eighths of an inch wide, inside measurements. The previous curve of the tonsillotome has been tempered out into a straight line. The holding teeth in the guillotine cage have been removed. In this way we have obtained a loop which is under perfect control by direct vision through a Martin speculum by reason of the removal of the curve.

Pain and bleeding are reduced, due to the removal of the teeth, and no tissue is traumatized. The only pain entailed is when the guillotine is drawn to. The guillotine knife, due to its sharpness and rapidity in cutting, is quite painless.

Technical Procedure. A Martin speculum well lubricated with a water soluble anesthetic lubricant is inserted into the anorectal canal. The obturator is withdrawn. The papilla is isolated, cleaned with a cotton applicator, and painted with a water soluble antiseptic. The papillatome is inserted into the Martin speculum, the guillotine portion is looped over the papilla, surrounding tissues carefully manipulated out of the grasp of the instrument, and the guillotine is then quickly drawn up by means of the trigger handle. Bleeding is slight and very easily controlled with slight momentary pressure.

COMMENT

A modified Myles lingual tonsillotome is presented, to be used as an efficient and simple method of removing anal papillae. This "papillatome" instrument has proved its worth.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

SEXTUS EMPIRICUS AND THE SCHOOLS OF MEDICINE DURING THE TIME OF GALEN*

MILTON B. HANDELSMAN, M.D.

Director of Student Health Service, Long Island College of Medicine; Associate Physician, Kings County Hospital (Long Island College Division)

BROOKLYN, NEW YORK

THE appearance of the recent translation from the Greek of the works of Sextus Empiricus by R. G. Bury[1] now makes the writings of this second century medical practitioner available to those who are not fortunate enough to read the classics. Although Sextus has written a philosophical treatise, the work abounds with interest to the present medical historian for at least three reasons. First, the schools of medicine which existed at the time when Sextus flourished (*c.* 190–200 A.D.) were sharply divided both in principles and practice. Sextus, who was identified by his contemporaries with the Empiric School, aligns himself in this work with the Methodist School, creating a problem for medical historians to solve. Second, from the writings of this man we are able to study the type of mind, as well as the philosophy of life, belonging to a general practitioner seventeen hundred years ago. Sextus stands out as the man who promulgated Skepticism not only as a method for dialectics but as a good approach for active research. Many twentieth century physicians can appreciate his "middle course" philosophy. Third, we can find interest in his work because many medical observations, probably made in his daily practice, have been used to illustrate his philosophic arguments. These are insufficient in quantity to allow one to create a system of his medicine, but they make one respect the acumen of the medical man in the period before the dark ages.

Sextus flourished about 190–200 A.D., the approximate date of Galen's death. Very little is known about his life. His medical writings have been lost and he is chiefly known by the philosophical treatise recently translated. While there is a scarcity of literature concerning his philosophic work, he has been given even less space in the textbooks of medical history.

The principal writings which have come down to us are three: (1) "Outlines of Pyrrhonism"; (2) "Against the Dogmatics" (the Logicians and the Physicists); (3) "Against the Ethicists." The first can be read with enjoyment; the other two are so repetitious and tedious in their pedantic

* From the Department of Medicine, Long Island College of Medicine. Read before the Section of Medical History of the Kings County Medical Society, November 12, 1937.

	Only Practical	Objective Study of Patients	Center Well-balanced	Subjectively Rational "Theorizing"	Irrational, Superstitious
Homeric	Simple first aid and household remedies.				Theurgy and libation.
Post-Homeric 6th Cent. B.C.	Practitioner trained by masters in practical ailments.				Oracles with cults of Aesculapius.
Transition to rational medicine 5th century. Age of Pericles, Socrates, Herodotus	Gymnasts. Rhizotomists.		1. Asclepiads (a) Rhodes (b) Cnidos Euryphron Ctesius (c) Cos Hippocrates 2. Philosophic schools (a) Crotona Pythagoreans Alkmaion Democedes Philolaos (b) Sicilian Empedocleans Akron Pausannios (c) Anaxagoran Archelaos (d) Democritus		Quacks.

Hippocratic Spirit—a synthesis of the ideas of the Coan, Cnidan, Sicilian, and Egyptian schools

Dogmatic era 4th century Plato and Aristotle				*Dogmatists*	
Alexandrian age 3rd century (Pyrrho)	In Rome, the father of the family was the physician.	*Empirics* (?)Timon Philinos	Herophilus Erasistratos	*Dogmatics*	In Rome, Etruscan gods and later Asclepius were worshipped.
2nd century B.C.	In Rome, poorly trained Greek physicians and quacks practiced.	*Empirics*		*Dogmatics* Herophilan Erasistratan	In Rome medical shrines.
Roman era 1st century B.C.		*Empirics* Heracleides		1. *Dogmatics* *Heropbilan* *Eristratan* 2. *Asclepiades* 3. *Metbodists* Themiston	
Roman era 1st century A.D.		*Empirics*	*Electics* Agathinos	1. *Dogmatics* 2. *Pneumatists* Athenaios 3. *Metbodists* Thessalos	
Time of Galen 2nd century A.D.		*Empirics* Menodotus	*Methodist* *Eclectic* Galen	*Dogmatics*	

arguments that they make understandable the lack of interest shown in the man. It is probably for this reason also that only two translations have appeared, one by Eugen Pappenheim[2] (in 1876) who translated the first book into German and one by Patrick[4] (in 1900) who made available in English only the first part of the first book.

A BRIEF REVIEW OF THE PRINCIPAL TENDENCIES IN CLASSICAL MEDICINE[4]

Before one can study the position of Sextus in the medical circles of his time, one must be familiar with the various schools of medical thought at the time and their historical background. In a chart we have attempted to summarize briefly this information. Without any idea of parliamentary alignment, we have put the groups which predominantly "studied books or theories" rather than the patient to the right of the center, and the groups which conducted objective studies of patients (on a rational basis) are kept to the left of the center. The purely practical groups occupy the extreme left and the purely superstitious are on the extreme right.

The birth of rational medicine came in the fifth century before Christ. Previously, treatment of surgical or medical disorders was accomplished by either purely practical or purely religious sects without any thought as to etiology, diagnosis, pathogenesis, and nosology. These groups occupy the extreme sides of the chart. In the fifth century, in which also lived Pericles, Socrates, Herodotus, etc., arose a medical spirit known to us now from the "Hippocratic Corpus." Actually the works of Hippocrates represent a collection of medical knowledge of the time, edited in Alexandria two centuries later under the direction of Ptolemy. It embodied the vast data accumulated by the healers in the temples (Asclepiads) along with information obtained from the philosopher-physicians of the fifth century, as well as the best material handed down by the Egyptians and Hebrews. In our chart we have placed these groups in the center, a position they deserve because they were characterized by a spirit of "open-mindedness." They observed facts and based all theory on what was observed. Principles of therapy were put on a rational basis and diagnoses and prognoses were formulated from what experience with patients had taught. Attempts were made to explain the causes and pathogenesis of illnesses. Each sect on the chart had its own pet theories, but interchange of ideas between the various schools did not allow theory to prevent studying the patient.

The "encyclopedic" Greek mind, however, was not satisfied with observation alone; it loved classification and argumentative speculation. In the century after Hippocrates those who were closest to Hippocrates himself lost the spirit of his work. His own son, grandson, and son-in-law, Polybus, continued his school with a rigid system of speculative medicine based on the humoral doctrine of Alkmaion. Facts were fitted into theory and often facts were discarded because they did not fit the theories. Research continued, particularly in anatomy and natural philosophy, but for the most part all findings were used to fit into the humoral doctrine. Minor variations existed among these sects, but they may be all lumped together as the "Dogmatics." Despite the brilliance of the contemporary Plato and Aristotle, in medical teachings there was an uncritical acceptance of the humoral dogma with further deductive theorization. We have shown this on our chart by the monopoly of the entire period by the Dogmatics to the right of the center. It was these same Dogmatic sects against which Sextus argued over five centuries later.

The Dogmatics were the dominant factors in medical thought during the next century, the Alexandrian Age, but a reaction was already setting in. It was during this time that Pyrrho of Elis, 360–275 B.C., whose philosophy Sextus fostered, lived and actively preached against the variety of dogmatic philosophies of the time. The

Empiric school of medicine arose with the growth of Pyrrho's Skeptical philosophical sect; in fact the founder, Timon, was a pupil of Pyrrho. The humoral doctrines were denounced by this group, clinical observation being encouraged and facts being accepted only because they were of practical value to the patient. This school persisted through the centuries and produced many good practical physicians although few figures were as outstanding as in the other schools. Their neglect of all medical theory put them in a position of opposition to the dogmatists and represented a swing of the pendulum to the other extreme. They became vehement deniers of the possibility of ever making medicine a science, and claimed (as Celsus quotes them): "The important question is not what causes disease, but what dispels it."

Thus we see already two opposing schools, the dogmatic Hippocratists and the skeptical Empirics. These persisted until the time which we are discussing (Galen, 200 A.D.). Individuals arose from these schools and brought in breaths of a fresh wind, rekindling the spark of scientific spirit in the fashion of Hippocrates. In the Alexandrian period, Herophilus and Erasistratos both attempted to create a more middling course, but their followers, like those of Hippocrates, soon were more interested in speculating and arguing about the theories of their founders than in following their masters' footsteps in building new and fresh medical thought.

During this period (the third century B.C.) medicine in Rome resembled the medicine of Greece in the fifth and sixth centuries B.C. With the decline of Alexandria and the rise of Rome, Greek medical men infiltrated Rome, at first the quacks coming and later the better trained Greek physicians. The latter brought with them the old opposing schools mentioned above. Asclepiades was probably the most prominent Greek physician to obtain a foothold in Rome. Although he was more or less of a charlatan, he led a movement to break away from both the Dogmatics and the Empirics. The Romans, particularly the influential Lucretius, were extremely enthusiastic about Epicureanism and the atomic theory of Democritus; this Asclepiades borrowed. According to him the body was composed of atoms with space around and pores to the outside. In the spaces flowed the "pneuma" which corresponded to the psyche. Hunger, for instance, was due to relaxation of the coarser pores and thirst from the relaxation of the finer pores. Asclepiades attempted to dislodge the Hippocratic humoral dogmatists only with his own dogma, and he still remains in the column to the right of the center.

However, he had opened a hole in the armor of both the Empirics and the old Dogmatics, and his pupil Themison (50 B.C.) in the breach founded a new school for medicine, the Methodists. This school too, at its onset, replaced dogma with dogma, but in its revolt away from the older dogmatics it paved the way for a more liberal spirit, and two centuries later during the time of Sextus it actually represented the "middle course" between the two older opposing sects mentioned above. Its pathology was simple and disease was either a contraction of the pores or a dilatation (relaxation). Clinical observation of the tone of the patient could determine what was happening; acute processes were usually due to a status strictus and chronic diseases to a status laxus. Treatment was instituted to correct the condition; to "relax" one bled, used warm baths, etc., while to "constrict" the physician used cold baths, narcotics, vinegar, etc. Although originally intended to emphasize a greater care in studying the patient himself for a diagnosis, this school soon became a narrow dogmatic sect. Thessalus, a pupil of Themison, taught all of Methodist medicine in six months and attracted shoemakers, smiths, weavers, etc., into the profession. People of this social class had been frightened out of the recognized medical schools because of the philosophic background needed to join both the Empirics and Dogmatics. During

the time of the Caesars, the Methodist school was probably the most popular Roman school.

In the next century, the Christian era, a new school, the Pneumatists arose. On our chart we have placed them with the dogmatic schools but they differed in that they served to shake both the powerful Hippocratic dogmatists who had maintained supremacy so long, and the newly popular Methodic School with its limited explanation of strictus and laxus. Athenaios, the founder, borrowed heavily from all schools as well as from the Stoic philosophy which was popular in Rome. Pneuma represented the godlike breath of life "pervading the human body and mind, and sickness was due to an abnormal condition of the pneuma." Much of physiology of this system was borrowed from the old Sicilian school of the third and fourth centuries B.C. They borrowed also the four cardinal humors of the dogmatists but they viewed these humors only as a pathologic product in the disease process and not as the cause of the disease. From the methodists they borrowed many points in therapy, particularly diet, baths, etc.

The Pneumatists grew under the influence of their students, particularly Agathinos, into the school of Eclectics, by sincere attempts to adopt the best practices and the most rational theories of all the other schools existing at the time. We have put the Eclectics in the center column because of their attempt to study their patients objectively and then to select explanations which represented to the best of their knowledge the facts presented. The most renowned surgeons of Rome, Archigenes and Antyllos, belonged to this school, and later the most renowned physician, Galen, classified himself in this group. At the time of the founding of the Eclectic school, the Methodist school was still under the influence of Thessalos who was busy fitting the diseases into the contracted or dilated states; the truly "middle course" Methodic school did not exist until the next century when Sextus subscribed to it. Sextus' teacher, Herodotos, was in fact an Eclectic.

THE PHILOSOPHY OF SEXTUS EMPIRICUS—PYRRHONIC SKEPTICISM

We come now to Sextus Empiricus in the second century A.D. He was called Sextus the Empiric by Diogenes Laërtius IX, because of his reputed adherence to the principles of the Empirical Medical School. In a medical treatise written during his life, the pseudo-Galenic "Isagogue," Sextus was again mentioned as an important figure in this Empiric School. We have spoken above of the close association of Pyrrho, the father of Skepticism, with the founding of the Empiric school. It is thus quite surprising that Sextus in the "Outlines of Pyrrhonism" should state "we should say that the Methodic School of Medicine has some affinity with Skepticism; and when viewed not simply by itself but in comparison with the other medical schools, it has more affinity than they."

Pappenheim[5] believes that Sextus was an Empiric in his early life before he became converted to the Skeptical philosophy, and later when a Skeptic, he followed the Methodical school. Such an explanation is probably closer to the truth than any other. The broader philosophic outlook of a person plays a great influence in that person's associations. Sextus was a man disgusted with the bickerings of the extremes in both the philosophic and medical sects, as were many other men, and in Pyrrho he found a "true center." The opening paragraph of his "Outlines of Pyrrhonic Skepticism" dramatically shows this: "It is usual for all who seek to trace down something either to find it, or to deny the possibility of finding it and acknowledge that it is beyond their apprehension, or to press on in their search. So perhaps this is also the case with those things sought through philosophic thinking. Some men claim that they have found the truth, while others assert that the truth cannot be apprehended, and still others continue their search. Those who think they have

found the truth we call by the distinctive name of Dogmatics, for example the Aristotelians, Epicureans, Stoics and other schools. The followers of Cleitomachus and Carneades and the other Academics are those who assert the impossibility of apprehending anything. And the Skeptics are those who continue the search."

Skepticism had been founded by Pyrrho (360–275 B.C.) who left no writings; it was Timon of Philius, the founder of the Empiric Medical School, who as a disciple of Pyrrho wrote his teachers' philosophy. Very little is known about Pyrrho. He accompanied Alexander the Great to India. He left Greece a strong admirer of Democritus and later became a true Skeptic. In general, the genius of the Greeks lay chiefly in their rational speculative ability and in their subtlety of expression. In Pyrrho these qualities are not the outstanding characteristics: he created no "system of philosophy" and his disciple Timon described him as desiring to escape from the tedious philosophic discussions of the time. Pyrrho resembled the "imperturbable" oriental philosophers with their indifference and futile outlooks. His trip to India and his contact with Oriental philosophers must have left an indelible stamp on his thinking.

Pyrrho's Skepticism is defined by Sextus as a mental faculty that studies with impartiality information obtained both by the senses (phenomena) and information which is conceived in the mind (noumena). The Skeptic was *not* a negativist; he accepted appearances (sense perception) of things as a standard of judgment. Sextus gives an example of honey. This appears to be sweet, a fact which the Skeptic accepted since he tasted the sweetness. But the Skeptic would not make up his mind as to whether honey was sweet in essence (in the metaphysical sense). In speculating about such a philosophical problem, the Skeptic would simply state what appeared to him, then proceed to find an opposing argument to either the affirmative or the negative, and then leave the discussion with an "open mind." When discussing non-evident things every argument for one side was opposed with an argument for the other side, and this "equipollence" would allow the philosopher to have mental composure. Sextus has emphasized again and again that the prime aim of Pyrrhonic philosophy was *mental composure*. E. G. Bury's[1a] comment on this is worth quoting: "Pyrrho would not seek or promise 'happiness' in the usual sense of the word, but he sought and taught the negative satisfaction of freedom from care and worry by the cultivation of a neutral, non-committal attitude towards all the problems of life and thought. Probably, then, the aim, if not the only interest of Pyrro was in the ethical and practical side of Skepticism as the speediest cure for the ills of life."

How a person attains mental composure by following the Skeptical method is explained by Sextus by an interesting illustration which we quote: "Wherefore, what is reported of Apelles, the painter, happens also to the Skeptic. For it is related how while painting the picture of a horse he wished to represent the foam of the horse in his picture; being unsuccessful he hurled at the picture the sponge which was used to wipe the colors from his brush, and when it touched the picture it made an exact representation of the foam." Mental composure follows suspension of judgment like a shadow follows its body.

Several "modes of how to attain ataraxia" are given by Sextus, but these are better entitled "arguments" as to why it is treacherous positively to affirm or deny what is not evident. These arguments were included to help the Skeptic confound the dogmata of his opponents. They are extremely interesting not only for philosophic students but also for the illustrations which give an insight to his medical observations.

If we can trust Sextus' interpretation of Pyrrho, we wonder why the Empiric Medical School associated with the Skeptics in the Alexandrian era did not flourish as a middle-course school. However when

the so-called Skeptics after Pyrrho and Timon are studied, one sees the same spectacle that happened after Hippocrates. Sextus disclaims all of them. Arcesilaus of Pitane who occupied the seat of Plato in the Academy (270 B.C.) considered himself a Skeptic. As one writer described him, "argument was the breath of his nostrils." To such a man, Skepticism was not a relief from endless dispute but a "possibility of argument endlessly open." His methods may have been skeptical, but not of the Pyrrhonic type, where mental imperturbability played such a great rôle. About eighty years after the death of Arcesilaus, Carneades led the Academy. He and his disciple Cleitomachus were also considered Skeptics, but like their predecessor, these men were typically Grecian in their desire for argumentation as well as prone to creating elaborate systematizations. Actually their views were that "nothing was apprehensible" instead of the attitude that things "may or may not be apprehensible." They were skeptical rather than Skeptics just as one may act childish and yet not be a child.

Following Pyrrho and the Academicians, a third personality, Aenesidemus, arose to foster the skeptical philosophy. Apparently he understood the true Pyrrhonic principles, but he is accused of being a "dialectical skeptic" despite his aiming for ataraxia. He later shifted his loyalty to Heracleitus. This argument about Aenesidemus which has engrossed the historians of philosophy, need not trouble us here. Following Aenesidemus not much is known of the Skeptical school until centuries later, when Menodotus (150 A.D.) and Theodas were criticized by Galen for their medical views. These men joined the Skeptical school with the Empiric Medical sect. Herodotos of Tarsus succeeded Menodotus as head of the Skeptic school, but medically he was associated with the Eclectics. Herodotos was succeeded by Sextus as the chief exponent of Pyrrhonism; Sextus associated himself with the Methodist sect.

From this short review of the history of the Skeptics it would seem that true Pyrrhonism was not very long associated with the Empirics. Possibly at the time of Timon and more probably only in the time of Menodotus was the association close. The *pseudo*-skepticism of the Academics and Aenisidemus fitted the negativistic Empirics more closely and this was the cause of Sextus' disavowal of the Empiric School.

It is very difficult to explain the apparent acceptance on the part of Sextus of the humoral theory as a natural affair in one part of his book. Neither the Methodists nor the Empirics originally believed in this. Sextus, in discussing the differences in sense perception among different animals, uses the humoral theory as a basis of his explanations. In the second book of the "Outlines of Pyrrhonism," where he criticized sophism, Sextus uses the medical vocabulary of the Methodist school as glibly as he used the humoral vocabulary before. From his writings it is thus difficult to classify Sextus in any school.

However a story related by him helps us place him as a physician. Bury's translation reads: "We are told of an amusing retort made by the physician Herophilus; he was a contemporary of Diodorus who, being given to juggling with dialectic, used to promulgate sophistical arguments against motion as well as many other things. So when Diodorus had dislocated his shoulder he came to Herophilus to get treated, and the latter jestingly said to him—'Your shoulder has been put out either in the place where it was or where it was not; but it was put out *neither* where it was *nor* where it was not; therefore it has not been put out'; so that the sophist begged him to leave such arguments alone and apply the treatment prescribed by medical art as suitable to his case." Sextus concludes, "For it is, I think, sufficient to conduct one's life empirically and undogmatically in accordance with the rules and beliefs that are commonly accepted, suspending judgment regarding the statements de-

rived from dogmatic subtlety and furthest removed from the usage of life."

With such a philosophy, Sextus must have been long searching for a medical school to which he could adhere. The Methodists suited his taste not so much because of their pathologic principles but because at the time of Galen in Rome the physicians of this group were of a different type than in the time of Thessalos and Themiston. As Sextus states, "It [the Methodist School] alone of the medical systems appears to avoid rash treatment of things non-evident by arbitrary assertions as to their apprehensibility or non-apprehensibility; and in accordance with what it observes, it derives from them what seems beneficial just in accordance with the ways of the Skeptics."

Gratitude must be expressed to Professor Harry De F. Smith who first interested the author in Sextus, and in whose seminar in Amherst College some of the translations included here were made with Rev. Paul C. Roundy.

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BOOK REVIEWS

THE LIFE OF CHEVALIER JACKSON. An Autobiography. New York, 1938. Macmillan. Price $3.50.

This is one autobiography of a physician that is truly outstanding. Not only is it beautifully written, but Chevalier Jackson has looked at his career objectively and treated his triumphs modestly.

He was born of honest, hard working parents. As a child he did not know what it was to play. Every member of his family "did things." At the age of ten years he was a craftsman and did remarkable wood inlay work, could use a lathe, and had a talent for drawing. His father met with adversity and carried on a losing battle until his death, so that young Chevalier worked for an education. He relates how he came to study medicine, and the struggles he endured to reach that goal.

He opened a modest office in Pittsburgh and early became a throat specialist. Having a penchant for devising instruments he designed and put into practice a gastroscope, which was, however, only a partial success. From this he began to work on instruments for removing foreign articles from the wind-pipe and larger bronchi. He never played, did not join his comrades in sport, but labored in his clinics and his private practice eighteen hours a day. Until he was 53 years old he hardly made his expenses. He suffered privations so he could journey to distant medical meetings. Three times during his life he suffered from pulmonary tuberculosis and had to go to bed for long periods of time. But even while in bed he was not idle. He found he could do no end of writing while taking a rest cure.

When he had reached the middle years he was called to Philadelphia. There he organized a clinic that became world famous. In time, he held professorships in five medical schools. He had one passion in life—to organize as many bronchoscopic clinics as possible, and to train as many physicians to do this work as time permitted. He preached early and late against the carelessness which allowed children to take lye mistakenly for sugar, with stricture of the esophagus resulting. He kept accurate records, and throughout the years fought to have the law demand that manufacturers of lye and lye substances put a poison label on their packages. Finally, he got to Washington and before a senatorial committee, and, in the end, won his long quest.

Meanwhile foreign governments honored him. He went to France and taught French physicians his art. British physicians, in turn, went to France to learn it. The name Chevalier Jackson became known around the world.

Now, a gentleman in his seventies, he can sit back secure in the knowledge that he has been a true medical pioneer, that he has carved a niche for himself among the immortals in medical history.

His autobiography is abundantly illustrated. One marvels at his skill as an artist. In fact, were he not a doctor of medicine, he would have been a professional artist and a fine one.

American physicians should read this life. The members of physicians' families will find it interesting and worthwhile. But if you know a young man about to begin the study of medicine, by all means, present him with a copy, for its reading will be stimulating and he will learn at first hand the ingredients that make a real doctor.

BILE. ITS TOXICITY AND RELATION TO DISEASE. By O. H. Horrall, M.D. Chicago, 1938. University of Chicago Press. Price $4.00.

When we finished reading this work we inwardly wished every abdominal surgeon and physician who meets with cases of liver and gall-bladder diseases would own a copy and read and reread parts of it carefully. For Dr. Horrall has offered us a critical summary of modern knowledge on the composition of bile and its relation to disease.

On the jacket we read, "Dr. Horrall records the development of scientific research into the character and physiologic action of bile, the methods used in clinical observation, and the results that have been obtained. Designed to stimulate fruitful research, to correlate and elucidate some of the clinical symptoms that appear in jaundice, and to aid the physician to a more scientific treatment of patients

with jaundice." Suffice it to say the author more than makes good on this blueprint.

The book (434 pages) is well written and easily read. The bibliography covers 123 pages. The index is adequate.

Originally completed in 1932, the whole book has been rewritten and revised in the light of more recent work, so that it is entirely up to date (July 1937).

Again, we repeat—surgeons who do abdominal surgery and internists who see cases of liver and gall-bladder diseases would do well to study carefully the contents of this far-above-the-average book.

Emergency Surgery. By Hamilton Bailey, F.R.C.S. (Eng.). Third Edition. Baltimore, 1938. William Wood.

The first volume of this work appeared in October 1930, and the second in August 1931. A reprint of the first volume appeared in 1932, and a second edition in 1936. This year we are offered a third edition. The popularity and worth of the book are therefore attested by the fact that the publishers, in these times, have the courage to bring out a new edition.

The author tells us that while writing the present volume he "pictured a patient stricken with an urgent surgical condition and a comparatively isolated surgeon called upon to carry out appropriate treatment." With this picture in mind he hoped that his pages would "help the latter to save the former." The author informs us that "Every case which I have been called upon to treat, and, earlier in my career, every important case at which I assisted, has been written up and indexed." The final work profits from those years of care and attention to detail.

All the usual, and many unusual, emergencies in surgery are covered. The author has an easy literary style. He gets to his point, and gets across to the reader what to do and what not to do, and when and why.

The book (852 pages) has 816 excellent illustrations, of which a large number are in color. There is an index.

Pediatric Surgery. By Edward C. Brenner, M.D., F.A.C.S. Philadelphia, 1938. Lea & Febiger. Price $10.00.

This satisfactory book lays stress on conditions peculiar to infants and children, and gives special attention to diagnosis, indications for operations, surgical therapy and end results. Dr. Brenner has used good judgment in restricting himself to material of practical value, and discusses the important common pathologies. However, he wisely has omitted orthopedic conditions, "since they are well considered in many textbooks." Many operations are described and the pre- and post-operative treatment is gone into thoroughly. The procedures recommended are in all cases based on approved methods or those evolved from the author's experience.

Dr. T. D. Buchanan cooperated on the chapter on the selection and administration of anesthetics; Dr. L. J. Unger on blood transfusions; Dr. H. S. Vaughan on cleft lip and palate; Dr. L. R. Davidson on thoracic surgery; and Dr. John E. Scarff on neurologic surgery.

The book is divided into nine parts, covering: General Considerations, Cysts and Tumors, Diseases of the Osseous System, Surgery of the Head, Surgery of the Neck, The Thorax, The Abdomen, Urologic Conditions (Drs. Clarence G. Bandler and Arthur H. Milbert), and Neurologic Surgery.

This book of 843 pages is illustrated with 293 engravings, and is well indexed.

The author in his preface says, "The child's body is no place for heroic surgery," with which all will agree; and all will agree that many good surgeons have not been specially trained to handle the surgical problems of childhood. This book fulfills the needs in this surgical field.

The Diary of a Surgeon in the Year 1751–1752. By John Knyveton, Licentiate of the Society of Apothecaries; Doctor of Medicine of the University of Aberdeen; Teacher of Midwifery to and Man Mid-Wife in Infirmary Hall; Surgeon's Mate, H.M.S. Lancaster. Edited and Transcribed by Ernest Gray. New York, 1937. D. Appleton-Century Company, Inc. Price $2.50.

For these vacation days, when physicians shy away from the heavier scientific tomes, here is a book to be enjoyed and appreciated while lying under a beach-umbrella, while sitting in the shade of a tree, or stretched out on the deck of a boat. Any physician who

starts "The Diary of a Surgeon in the Year 1751–1752," written by John Knyveton (a physician of those days) and edited and transcribed by Ernest Gray, will not, we venture to predict, put the book down until he has finished with it, unless the interruption be necessary and important.

We read in the Editor's Note that "Wounds were encouraged to suppurate that the body might the quicker rid itself of its base portions." " . . . whilst letting the main portion of the Diary speak for itself [the editor] has thought fit to alter the names of many that appear in it, and above all the name and position of the hospital at which John Knyveton attended. The conditions at 'Infirmary Hall' were those of every hospital at the time, but there are those who might think the editor had some axe of his own to grind were he to allow the hospital to be named."

Young Knyveton had a glorious two years of adventure, although during that time he nearly died. But between his lines we see London during the middle years of the eighteenth century, we go to sea and suffer the privations of the times, and eat the food common on such voyages; we see disease at first hand and marvel at the methods of treatment; we ride out storms and come to anchor in strange harbors. A book of adventure, and, at the same time, a history of the manners, customs and medical practice of nearly two centuries ago.

There are eight illustrations. And, one may add, there is not a dull page in the entire book.

When you have finished with it, before you will have had a chance to put it away on a library shelf, other members of your family will have buried themselves within its covers, or your friend will casually borrow it, and, in turn, lend it to another friend. For, it's that kind of book . . . one read with satisfaction and pleasure, and then passed on for others, also, to read and enjoy.

Surgery of the Sympathetic Nervous System. By George E. Gask, C.M.G., D.S.O., F.R.C.S. (Eng.) and J. Paterson Ross M.S. (Lond.), F.R.C.S. (Eng.). Second edition. Baltimore, 1937. William Wood & Co. Price $4.50.

The second edition of this work is an improvement on the first, since there has been a careful revision of the whole book. "Important new features are the sections on the clinical grading and prognosis of Raynaud's disease, on the recognition of localized structural disease of the main arteries, on afferent pathways in the sympathetic system, and on sympathectomy for dysphagia."

The same care and attention revealed in the first edition are shown in the approach to anatomy and physiology of the sympathetic nervous system.

New readers need not be dismayed by the title, for the book is written in the style typical of the English school, with brevity and clarity, and numerous carefully selected and illustrative case reports. The drawings, diagrams and photographs, fifty in number, round out this simple treatise of 186 pages.

One anxious to acquire a basic scientific knowledge of this subject should find a very satisfactory answer in this book.

The Practice of Urology. By Leon Herman, B.S., M.D. Philadelphia, 1938. W. B. Saunders Company. Price $10.00.

Dr. Herman, Professor of Urology, at the University of Pennsylvania Graduate School of Medicine, is well equipped by training, experience and position to write a practical treatise on diseases of the urogenital system. He tells us his work is intended particularly for the use of the general practitioner and surgeon. With these needs in his mind the author has dealt largely with methods and procedures employed daily in diagnosis and treatment. Adequate space is given to controversial problems. The sections on gonococcal infections and their sequelae, and on venereal ulcerations are particularly extensive, and rightly so.

Most of the illustrations (501 in number) are from cases that came under the author's care in the Pennsylvania, Methodist Episcopal and Bryn Mawr Hospitals. The sections on roentgenographic technique and spinal anesthesia were written by Paul Bishop and Orville King, respectively.

This well written work (923 pages), largely a record of Dr. Herman's own clinical experience, is beautifully illustrated and amply indexed. It is a comprehensive guide in every detail to urologic practice. A book one will refer to frequently and a book that leaves one satisfied after reading.

The Physiological Basis of Medical Practice. A University of Toronto Text in Applied Physiology. By Charles Herbert Best, M.D. and Norman Burke Taylor, M.D. Baltimore: William Wood & Co., 1937. Price $10.

This is an important book, and every physician, either a young or an old graduate, would do well in making it compulsory reading. Had we our way we would have medical students own a copy for undergraduate study, and postgraduate perusal. It would prove a good investment. In the Preface the authors state, " . . . we feel that the teacher of physiology in a medical school owes it to his students, whose ultimate interest it must be conceded is in the diagnosis and treatment of disease, to emphasize those aspects of the subject which will throw light upon disorders of function. The physiologist can in this way play a part in giving the student and practitioner a vantage point from which they may gain a rational view of pathological processes."

When the authors tell us that they have "endeavored to write a book which will serve to link the laboratory and the clinic. . . ." we hasten to state that they have fulfilled these promises.

There would be no sense or reason in going minutely into the contents. Suffice, that the subject is thoroughly covered, and that the authors are men of wide reputation and one has no desire to debate the controversial points of their conclusions.

We would have reviewed this work earlier except we put it aside for our very late night reading, and have been a long time going through it. It opened a new world to us after three decades, a time when we had to be interested in such matters. We found we reread certain parts and chapters. There was so much of interest to one engaged in the practice of medicine that every page seemed more instructive and fascinating than the one that had gone before.

While we have been writing this inadequate review we opened the book, and found ourself reading in it here and there instead of getting this pleasant task completed.

The book is 1684 pages long, has a colored frontispiece, 399 illustrations, an ample Index, and a hundred pages devoted to References.

A good book, and a valuable one; it deserves a wide popularity.

The Postmortem Examination. By Sidney Farber, M.D. Springfield, 1937. Charles C. Thomas. Price $3.50.

This book makes available an orderly presentation of the methods used in the performance of a complete autopsy. Dr. Farber says, "The medical student should be encouraged to develop the 'autopsy habit' early in his career." The author also tells us that the best way to learn autopsy technique is in the autopsy room, under the direction of a skilled pathologist. For the beginner, however, Dr. Farber's monograph may serve as an introduction to the actual performance of an autopsy and as a means of shortening the period of ineffective work and distress characteristic of the early days in any new field.

After an historical introduction the following chapters are offered: General Considerations, Equipment, Regulations Governing the Postmortem Examination, Inspection of the Body, Removal of the Viscera, The Cranial Vault and Spinal Cord, Section of the Viscera, Examination of the Skeleton, Autopsy Technique for Special Cases, Special Procedures, and Postmortem Examinations on Infants and Children.

In the appendix are tables of average weights or organs, a copy of the report of the New York Committee on Rules Governing Pathologists and Undertakers, and a protocol by Virchow.

There are thirty-two illustrations and an index.

Teachers of pathology can list this book for student use with the knowledge that they are recommending a solid work on this subject.

Some Fundamental Aspects of the Cancer Problem. Symposium Sponsored by the Section on the Medical Sciences of the American Association for the Advancement of Science. Edited by Henry Baldwin Ward. New York, 1937. The Science Press. Price $2.50.

This book of 248 pages represents a collection of the papers on the various aspects of cancer read at the meeting held at Atlantic City, December 29, 1936–January 1, 1937.

The thirty-one papers comprising the volume cover the following broad fields: Heredity and Constitutional Factors (seven articles); In-

duction, Stimulation and Inhibition of Tumorous Growths (nine articles); Metabolism of Cancerous Tissue (five articles); Radiation (seven articles); and General Discussion of the Cancer Problem (three articles). The authors are widely known workers in this field.

The book is well printed, bound and illustrated, but contains no index. However, physicians will find much good meat in the fare offered.

THE COLON AS A HEALTH REGULATOR—FROM A SURGEON'S POINT OF VIEW. THE EFFECTS AND TREATMENT OF ITS DEVELOPMENTAL ABNORMALITIES. By Sir Henry M. W. Gray. New York, 1937. Macmillan Co. Price $2.50.

This is an interesting book of 100 pages. The author is to be complimented on sticking closely to his thesis and not resorting to overwriting and padding in order to make a larger looking book.

This treatise does not discuss tumors or inflammatory disease of the colon. It deals with anatomic abnormalities of the bowel, which are developmental in origin. The author tells us that "Generally speaking these abnormalities resemble conditions in four-footed animals which are not suited for the upright position of man. . . . Relief from symptoms produced by them is frequently obtained when a horizontal position is assumed. . . . To regard such a highly developed organ as the colon merely as a 'cesspool' (Lane) is to cast aspersions on the Intelligence which designed it. The colon . . . under mechanical handicaps which have not yet been eliminated by evolutionary factors . . . [offers cases which] surgery can help very often when the whip of medicinal stimulus is doomed to failure."

The illustrations are especially well done. The author writes with a facile pen, and when one finishes this all too short book, he is sure to have a better understanding of this many sided subject.

SPECIAL ARTICLE

Pitfalls in the Diagnosis *of* Acute Abdominal Conditions

BY

ALTON OCHSNER, M.D.

Professor of Surgery, Tulane University School of Medicine

AND

SAMUEL D. MURRAY, M.D.

Assistant in Surgery, Tulane University School of Medicine

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PITFALLS IN THE DIAGNOSIS OF ACUTE ABDOMINAL CONDITIONS*

ALTON OCHSNER, M.D. AND SAMUEL D. MURRAY, M.D.

Professor of Surgery, Tulane University School of Medicine

Assistant in Surgery, Tulane University School of Medicine

NEW ORLEANS, LOUISIANA

AFTER making a correct diagnosis, the well trained surgeon has little difficulty in adequately treating a patient with acute abdominal manifestations. The desirability of a correct preoperative diagnosis in a case with acute abdominal manifestations is obvious, but in spite of refinements in diagnostic methods there are still many cases in which such accuracy is impossible. An exact preoperative diagnosis is not only of academic interest, but also of practical importance because when it is possible the subsequent morbidity and mortality will be considerably decreased. Diagnosis in cases with abdominal symptoms and signs is particularly difficult because these manifestations may be associated with practically every disease in medicine.

Because pain is a prominent manifestation in abdominal disease, a review of the nerve supply of the abdominal wall and a consideration of the mechanism of the production of pain is advisable. The lower seven intercostals, the ilio-hypogastric, and ilio-inguinal nerves supply the abdominal skin from the xyphoid and costal margin to the pubes and inguinal ligaments. The eighth intercostal nerve supplies the area midway between the xyphoid and umbilicus, the tenth, the region of the umbilicus, the last thoracic, ilio-inguinal, and ilio-hypogastric nerves supply the region of the inguinal ligament and the pubes. The ilio-hypogastric supplies the skin over the subcutaneous inguinal ring and the ilio-inguinal that over the spermatic cord and scrotum.

The innervation of the parietal peritoneum is by the somatic nerves supplying the adjacent cutaneous areas, whereas the visceral peritoneum and corresponding viscera are supplied by the sympathetic nerves through the splanchnics. As shown by Head,[1] there is a close association of the afferent sympathetic visceral fibers and

* From the Department of Surgery, School of Medicine, Tulane University of Louisiana, New Orleans, La.

the afferent somatic fibers in the posterior root of each spinal nerve. This is the reason for the referred somatic pain and hyperesthesia in visceral disease. He explains the mechanism as follows: "When a painful stimulus is applied to a part of low sensibility, in close central connection with a part of much higher sensibility, the pain is felt in the part of higher sensibility rather than in that of lower sensibility to which the stimulus is actually applied."

There are two types of abdominal pain: (1) the visceral, which is diffuse and widespread, and is usually due to distention or powerful contractions of the bowel; and (2) peritoneal, which is localized and accompanied by tenderness, muscular rigidity, and cutaneous hyperesthesia. The pain associated with distention of a hollow viscus, which is usually the result of obstruction, is colicky, with intervals in which the patient is free from symptoms. During the attack the pain is agonizing and there is considerable restlessness in an attempt to alleviate it. The pain accompanying peritonitis is constant, unrelenting, and increasing. The patient avoids all movements and usually lies quietly in bed with the thighs flexed on the abdomen.

The two types of pain are well illustrated in infections of the appendix. When the lesion is still confined to the appendix, as the result of distention of the viscus the patient experiences diffuse colicky pain in the region of the umbilicus and the epigastrium. Later as the pathologic process progresses with involvement of the surrounding parietal peritoneum, the pain loses its intermittent character, becomes localized in the right lower abdominal quadrant, and is associated with tenderness and muscular rigidity.

Differentiation between visceral and peritoneal pain is of value in the differential diagnosis between biliary calculi and ruptured peptic ulcer. In the former instance the pain, which is visceral, is intermittent, colicky, and severe. It is relieved almost instantly by the use of antispasmodics, such as amyl nitrite, as has been demonstrated by Butsch et al.[2] In such cases opiates frequently aggravate the symptoms because they increase rather than relieve the sphincteric tone. The pain associated with ruptured peptic ulcer, which is due to stimulation of the peritoneum by the highly irritating gastroduodenal juices, is constant, agonizing, and accompanied by abdominal muscular rigidity.

Abdominal manifestations may be due to changes which are: (1) inflammatory; (2) cardiovascular; (3) respiratory; (4) urogenital; (5) systemic; (6) gastrointestinal; (7) cerebrospinal; (8) skeletal; (9) muscular; (10) endocrinic; (11) allergic; (12) lymphatic; and (13) neoplastic.

INFLAMMATORY

Appendicitis is by far the most frequently encountered acute inflammatory condition in the abdominal cavity, constituting, according to Eliason,[3] from 75 per cent to 90 per cent of such lesions. Diseases of the gall-bladder and bile ducts rank next, and, following in order of frequency are renal and ureteral lesions, gastric and duodenal disorders, diseases of the female genital system, intestinal obstruction, and acute pancreatitis.

Despite its frequent appearance, inflammation of the appendix may present symptoms to puzzle the most experienced, and on the other hand, the constant thought of this common condition may result in its erroneous diagnosis. It has been said that the majority of mistakes in appendicitis arise in connection with the diagnosis. The most crafty of experienced practitioners will be deceived now and then—the careless and inexperienced will err perpetually. Although ureteral and vesical lesions are probably more frequently overlooked when an erroneous diagnosis of appendicitis is made, appendiceal lesions may present symptoms and signs referable to the urinary tract. An inflamed appendix overlying the ureter will produce ureteritis with pain radiating to the penis and scrotum. Similarly, an acutely inflamed pelvic appendix is likely to produce a cystitis with urinary symptoms. In a retroperitoneal position, higher than its normal location, the diseased appendix may produce abdominal findings which are indistinguishable from those of gall-bladder disease. If tenderness is present, it may be limited to the groin. Occasionally cases are seen in which in spite of severe infection of the appendix there are few or no manifestations. Although as emphasized by Wangensteen and Bowers,[4] appendices are frequently unnecessarily removed, the fact that there are from 18,000 to 20,000 fatalities annually from acute appendicitis indicates that too little importance is placed upon appendicular colic.

Lesions elsewhere in the abdomen frequently simulate appendicitis. In the female, appendiceal inflammations are likely to be confused with inflammations of the right Fallopian tube because of the close proximity of the two viscera. This is particularly true in 25 per cent of the cases in which the appendix occupies a pelvic position (Kelly[5]). In cases with acute upper abdominal manifestations there is considerable difficulty in differentiating between acute cholecystitis, perforated peptic ulcer, and acute pancreatitis. An accurate preoperative diagnosis is probably not essential because the treatment in each instance consists of early operation, even though

until recently delayed operation in acute cholecystitis was considered preferable. Lower right abdominal quadrant pain, tenderness, and rigidity can occur in ruptured peptic ulcer, as emphasized by Haggard,[6] as the result of intraperitoneal gravitation of gastric contents into the right iliac fossa.

The presence of blood in the peritoneal cavity produces an acute irritation which is frequently indistinguishable from a bacterial peritonitis, particularly when pyrexia develops in the reactionary period (Marshall[7]). Extra-peritoneal inflammations and hematomas such as urinary infections and retroperitoneal bleeding following kidney rupture, because they cause splanchnic irritation produce fever, abdominal pain, and adynamic ileus which are identical with the manifestations in peritonitis. In subcutaneous injuries to the abdomen with kidney rupture, because of the associated signs of ileus it is frequently impossible to eliminate preoperatively the possibility of rupture of an intra-abdominal viscus. Although unnecessary laparotomy is undesirable in such cases, the danger of overlooking an intraperitoneal lesion is too great to assume that none exists. We believe that either a small exploratory incision should be made or abdominoscopy performed, neither of which should add materially to the risk. On the other hand, Backeys[8] is of the opinion that abdominal exploration in such cases delays the patient's convalescence.

Pneumococcal peritonitis is a dangerous disease, practically confined to girls of school age, which is often confused with appendicitis. Short[9] emphasizes that the diagnosis is fairly easy in a typical case. The symptoms of general peritonitis occur soon after the onset, without any localization in the right iliac fossa. There is an early diarrhea, and the illness is obviously severe.

Clinical manifestations of acute appendicitis frequently occur in patients suffering from upper respiratory tract infections, especially tonsillitis and pharyngitis. These are undoubtedly due to the invasion of the appendicular lymphatics by the same micro-organisms producing the acute tonsillitis. Whereas usually in both infections the disease process subsides spontaneously, not infrequently the lesion progresses in the appendix, necessitating its extirpation. In such cases appendicitis can appear almost in epidemic form.

CARDIOVASCULAR

Coronary disease manifested by attacks of severe abdominal pain, nausea, vomiting, fever, and leucocytosis is particularly likely to be confused with upper abdominal lesions such as cholecystitis, perforated peptic ulcer, and pancreatitis. Many[10–15] have stressed

that coronary disease and possibly other cardiac lesions can so closely simulate an acute abdominal catastrophe that an accurate diagnosis is almost impossible. The hazard of an operation on a patient with coronary thrombosis is obvious and every effort should be made to differentiate the cardiac and abdominal lesions.

Barker, Wilson and Coller[10] emphasize that whereas most physicians are cognizant of the fact that coronary disease can produce abdominal symptoms, few realize that an acute abdominal lesion can produce symptoms of coronary disease. In such cases the evaluation of the symptoms and the correct diagnosis are particularly important, as suggested by Brooks.[16] Barker, Wilson and Coller[10] and Storey[15] aptly state that although it is dangerous to mistake coronary disease for an acute abdominal emergency, it is much worse to consider a case with perforated peptic ulcer to be suffering from coronary occlusion or spasm.

According to Rieman,[17] both hypertension and cardiac disease produce symptoms of distention, anorexia, upper abdominal tenderness, nausea and vomiting, which in several cases led to an erroneous diagnosis of malignancy. Passive congestion and enlargement of the left lobe of the liver is occasionally interpreted as an epigastric neoplasm.

Lesions of the pericardium such as hemopericardium, hydropericardium, and pericarditis produce abdominal pain, probably due to direct involvement of the diaphragmatic peritoneum by the contiguous inflammatory process extending from the pericardium. In case the inflammatory process is limited to the diaphragmatic portion of the pericardium, the diagnosis may be difficult to make, because a friction rub in such an instance might not be heard on examination of the heart. Rupture of the heart, according to Salzmann,[18] frequently simulates an acute abdominal catastrophe in that abdominal pain may be the only symptom. He reports a case of a patient who for four years had recurrent attacks of severe epigastric pain relieved by vomiting and alkalies. An appendectomy revealed a normal appendix. Later, after a Sippy diet failed to afford relief, a gastroenterostomy was done. Autopsy after four years of these recurrent attacks revealed occlusion and sclerosis of both coronaries with infarction associated with perforation of the left auricle just above the base of the posterior mitral cusp. According to Salzmann, rupture of the heart may be confused with acute pancreatitis, cholecystitis, kidney colic, and intestinal obstruction.

Angina abdominis, described by Lakin,[19] is an entity in which as the result of sclerosis of the celiac and mesenteric arteries there

occurs a sudden rise in the arterial pressure with the production of unlocalized, widespread abdominal pain, not accompanied by tenderness. The pain is usually relieved by the administration of vasodilators such as amyl nitrite and nitroglycerine.

Abdominal aneurysm can produce abdominal symptoms in a number of different ways, i.e., by mechanical pressure on contiguous viscera and nerves, and by direct extension or rupture of the aneurysm. An acute surgical abdominal condition can be mimicked by rupture of the abdominal aorta, as exemplified by the cases described by Osler,[20] Lakin,[19] Bonar,[21] and Neely.[22] In five cases of ruptured abdominal aorta reported by Neely, abdominal pain was the most frequent symptom, being present in all cases.

Friedberg and Gross[23] emphasize that the possibility of periarteritis nodosa should be considered in cases of rheumatic fever or rheumatic heart disease having marked abdominal symptoms. That periarteritis nodosa can be the cause of an acute abdominal process is well exemplified by a recent case of the authors'. A patient recovering nicely from a right total pneumonectomy for bronchial carcinoma, on the sixth postoperative day developed abdominal pain, fever, distention, nausea, and vomiting. In spite of conservative therapy (because the real cause of the symptoms was not considered), a fatal exitus occurred two days later. At autopsy there was found massive gangrene of the small bowel, which was secondary to a widespread periarteritis nodosa of the mesenteric vessels.

Sclerosis of the abdominal vessels with subsequent thrombosis produces splenic infarction and mesenteric thrombosis, which in turn produce manifestations of an acute abdominal catastrophe. Generally the true nature of the underlying lesion is not known before the opening of the abdomen. In elderly individuals with evidence of arteriosclerosis elsewhere one is justified in suspecting a similar intra-abdominal process complicated by thrombosis. Mesenteric thrombosis has been observed in relatively young individuals after prolonged bouts of alcohol imbibition (Storck[24]).

Acute vascular occlusion of the mesenteric vessels can occur as the result of embolism.[14,25] According to Dunphy,[25] the pain in such an instance is the result of anoxemia of the intestinal musculature. It is constant and unassociated with tenderness and rigidity until peritonitis supervenes. Of diagnostic importance, according to Dunphy, is the contrast between the severity and persistence of the pain and the paucity of physical findings. Spasm of the mesenteric vessels doubtless produces pain which is similar to that experienced following exclusion of the vessels by a thrombus, with the principal

exception that whereas in the latter the condition persists and is complicated by peritonitis, the former subsides spontaneously. In a case, however, with evidence of mesenteric occlusion one is not justified in delaying operation in order to determine preoperatively whether the vascular occlusion is due to spasm or an organic lesion, because the complicating lesions, gangrene of the bowel, perforation, and peritonitis, offer such a poor prognosis that they should be prevented. Whereas an unnecessary operation is undesirable in the case with functional vascular occlusion, it is far less dangerous than delay in a case with organic mesenteric vascular obliteration.

Other mechanical obstructions of the mesenteric vessels, such as thrombo-angiitis obliterans can produce abdominal manifestations. Cohen and Baron[26] report fifteen cases in which there was probable involvement of the mesenteric vessels by thrombo-angiitis obliterans. Four of these were proved, two doubtfully proved, and in the remaining nine the diagnosis was presumptive. These authors are of the opinion that in many patients with thrombo-angiitis obliterans of the extremity who have indefinite abdominal symptoms these symptoms may be due to either spasm or obliteration of the mesenteric vessels. They further state that the clinical picture is that of partial intestinal obstruction, which consists of abdominal pain, vomiting, obstipation, diarrhea, distention, and fever.

RESPIRATORY

It is well known that pneumonia, particularly in infants and children, can simulate acute abdominal conditions. The diagnosis is particularly difficult in those cases in which the pulmonary lesion is centrally located and in which relatively few signs referable to the thorax can be demonstrated on physical examination. McClure[27] is of the opinion that observation of the respiratory abdominal movement is of great diagnostic importance in differentiating between pulmonary and abdominal lesions. He states that in 79.7 per cent of sixty-nine definite cases of acute appendicitis, the abdominal respiratory movement was definitely less than the thoracic movement, in contrast to the normal child in whom the amplitude of the abdominal curve is greater. In patients with respiratory lesions such as pneumonia, there is no restriction of the abdominal respiratory movements. In only one instance of six cases of pneumonia, of which five were lobar and one of the postoperative type, was there such restriction in McClure's cases, although in all the cases there was abdominal tenderness and rigidity. Riesman[17]

emphasizes that, although it is extremely desirable to detect the pulmonary lesion in children, it is even more so in adults, because children with pneumonia who have an appendectomy usually recover in spite of the trauma, whereas adults rarely do. Riesman further believes that many of the so-called ether pneumonias are in reality preëxisting pneumonias which were not recognized and which presented abdominal symptoms. Frequently in children roentgenograms are necessary in order that a central pneumonia can be diagnosed. That acute pulmonary parenchymal infection, such as pneumonia, can occur concomitantly with acute infection of the appendix, is illustrated by two cases which Brooks[16] observed within a month. Both of these patients had acute lobar pneumonia and in addition had acute appendicitis. Fortunately, the latter condition was recognized and the patient operated on successfully. Inflammation of the pleura irrespective of its cause, particularly if the diaphragmatic pleura is involved, will give rise to abdominal manifestations, probably because of the contiguous inflammatory process of the diaphragmatic peritoneum.

Chronic inflammatory lesions of the pulmonary parenchyma, particularly tuberculosis, frequently give rise to gastrointestinal manifestations even though there is no associated gastrointestinal disease. Brown[28] studied 400 patients with pulmonary tuberculosis with no evidence of intestinal involvement. He observed that the gastrointestinal symptoms were usually more marked during acute exacerbations or in the acute fulminating type. The symptoms most frequently complained of were anorexia, epigastric or substernal distress, heaviness after meals, occasionally acute pain, nausea from time to time resulting occasionally in vomiting, distention, flatulence, constipation, and diarrhea. Brooks[16] emphasizes that many patients with chronic pulmonary infections are admitted to gastrointestinal clinics because of these manifestations and that the real condition is not diagnosed until examination of the chest is made.

Spontaneous pneumothorax can produce a clinical picture of an acute abdominal catastrophe simulating ruptured peptic ulcer. A sudden onset of pain following violent exercise with radiation to the shoulder region, dyspnea and collapse, and assumption of the sitting position with the legs drawn up are frequently found in spontaneous pneumothorax, as emphasized by Steigmann and Singer.[29] These authors contend that this lesion produces abdominal manifestations much more frequently than is commonly supposed and is frequently overlooked, either because examination of the thorax is not made or because in those instances in which the thorax is examined, the

pneumothorax may be only partial and difficult to detect on physical examination.

Lower stage thoracoplasty is frequently followed by abdominal distention, nausea, and vomiting, which is probably the result of an ileus caused by stimulation of the splanchnic nerves in the retropleural space.

UROGENITAL

Disease of the kidneys and ureters frequently produces abdominal symptoms. The clinical manifestations of lesions in the upper part of the urologic tract resemble those of gastric ulcer, cholecystitis, etc., whereas those in the lower portion are often confused with appendicitis, intestinal obstruction, and salpingitis.

Urinary tract disease may manifest itself only by symptoms referable to the gastrointestinal tract, viz., nausea, vomiting, anorexia, constipation, and occasionally diarrhea. According to Fleischman[30] these symptoms can be produced in one of two ways. Because of renal stasis, there is inadequate elimination of toxic products in the urine, resulting in gastrointestinal manifestations through the effort on the part of the body to rid itself of these waste products by other means. Also, the sympathetic nerves supplying the kidney and ureters are intimately connected with the sympathetic nerve supply of the stomach and large and small intestines. In suppurative lesions of the urologic system, such as perinephritic and renal cortical abscesses, in proximity to the peritoneum, a localized peritonitis can occur as the result of contiguity of the inflammatory process. Duncan[31] emphasizes that an acute seminal vesiculitis with beginning epididymitis is likely to be confused with acute appendicitis unless one is mindful of the possibility of the genital lesion.

The colicky pain associated with ureteral obstruction by pressure from without or within may be confused with appendicular colic because of the location of the pain and the presence of tenderness. Ureteral stone on the right side is particularly likely to be mistaken for appendicitis. Marshall[32] even states that the presence of an appendectomy scar is an extremely frequent indication of the presence of a calculus in the right ureter. Hess[33] reports that in eighty consecutive cases of stone in the kidney or ureter, only two patients (2.5 per cent) had not had previous abdominal operations for the same symptoms. Many had had repeated laparotomies. Although Hess's experience is probably unique as regards the incidence (97.5 per cent) of overlooked ureteral calculi, it emphasizes

the necessity of considering such a lesion in all patients with right lower abdominal quadrant pain.

Infections of the kidney with fever, leucocytosis, and pain in the right side of the abdomen are particularly likely to be confused with a suppurative appendicitis. As a rule, careful examination of the urine will reveal the presence of the urinary infection. Generally, too, the elevation of the temperature is higher and the leucocytosis greater in cases of pyelitis than in appendicitis. It is unusual in uncomplicated cases of appendicitis for the temperature to rise higher than 102°F. and the leucocyte count to be greater than 20,000 per c.mm. As emphasized by Duncan[31] and Brown,[28] infections of the kidney pelvis are particularly difficult to diagnose in those cases in which the ureter is plugged, because of the absence of urinary findings. Similarly, perinephritic abscesses which do not communicate with the kidney pelvis show no urinary changes.

Abdominal trauma resulting in injury to the kidney not infrequently produces symptoms referable only to the abdomen, the only manifestation of the kidney rupture being hematuria. The abdominal manifestations are those of peritonitis, the result of peritoneal irritation and irritation of the retroperitoneal sympathetic nerves, the splanchnics. Nausea and vomiting, abdominal distention, and ileus usually occur and, although the diagnosis of renal rupture can be made fairly accurately, one can never *definitely* rule out the possibility of an intra-abdominal viscus until an exploration has been done. Whereas Backeys[8] is of the opinion that these patients should not be laparotomized, we feel that such a procedure done correctly through a very small opening is far preferable to watchful waiting in a case in which there is an associated intraperitoneal lesion. A laparotomy could be dispensed with in those cases in which abdominoscopy is used. One of the authors (A. O.) a number of years ago observed a young patient who had fallen about 15 feet, striking the left flank against a sharp object. The patient was admitted to the hospital in shock, but with all the manifestations of a peritonitis. There was nausea and vomiting, fever, and abdominal distention. Because of the associated hematuria, a diagnosis of renal rupture with a probable intraperitoneal lesion was made. After the patient had recovered from shock a small abdominal incision was made, which, however, revealed that all the intraperitoneal viscera were intact. The laparotomy did not alter the patient's convalescence and, even though it was unnecessary in this particular case, it was far better to subject the patient to the operation rather than overlook an existing intraperitoneal lesion.

Occasionally, distention of the urinary bladder will produce marked abdominal pain which may be confused with an intraperitoneal tumor. In any case with low abdominal tumor apparently arising out of and fixed to the pelvis, examination should always be done after catheterization in order to eliminate the possibility of bladder distention.

Acute abdominal manifestations can result from torsion of the testicle. This is particularly difficult to diagnose if the testicle is undescended, even though the absence of the testicle from the scrotum is noted (Bier[34]).

In all acute abdominal lesions it is essential to obtain a careful menstrual history in order not to overlook an ectopic gestation. Even after obtaining such a careful history (which may be misleading), one is likely to err. This is particularly true, as emphasized by Storey,[15] in cases in which, because of the escape of blood from the pelvis into the upper abdomen, the manifestations at the time the patient is seen are those of an upper abdominal lesion.

Hemoperitoneum resulting from leakage from the abdominal ostia of distended Fallopian tubes produces peritoneal irritation; infested peritonitis can result. According to Garrell,[35] gynatresia is a frequent cause of lower abdominal pain or retention of urine in a girl or woman who has never menstruated. Imperforate hymen is by far the most common form of gynatresia, over 1,000 cases having been reported.

Inflammations of the appendix and right Fallopian tube frequently produce similar symptoms and signs. The difficulty in the diagnosis arises because of the close proximity of the two viscera and the similarity in the manifestations of the acute inflammatory processes occurring in them. Differentiation between these two processes is essential, because acute salpingitis is best treated conservatively and non-operatively, whereas the only treatment of acute appendicitis is immediate surgical removal of the diseased appendix while the inflammation is still confined to it. Smears from the urethra, Bartholin's glands, Skene's ducts, and the cervical canal are of great importance. If gonococci are found the condition is probably salpingitis. Fitz-Hugh[36] has described a clinical entity resulting from acute gonococcic perihepatitis occurring in young women. Although a careful history will reveal that there has been lower abdominal pain for several months, in association with leucorrhea and dysuria, the principal manifestations are severe pain in the upper right abdomen, fever, and frequently gastrointestinal symptoms. Tenderness is marked along the right costal margin and there

is limitation of the right diaphragmatic excursion. Because of the location of the inflammatory process, it is likely to be confused with cholecystitis.

An ovarian cyst with a twisted pedicle may present symptoms of peritonitis or intestinal obstruction. In a case reported by Frank[37] a true obstruction was caused by a loop of bowel becoming involved in the twist.

SYSTEMIC

Systemic infections frequently begin with abdominal symptoms, these being probably the result of the associated toxemia. As emphasized by Carnett,[38] there occurs in such cases acute parietal pain and tenderness. In a large number of cases of acute hematogenous osteomyelitis the first manifestations are nausea, vomiting, and leucocytosis.

Guptill[39] and Wolffe and Brim[40] emphasize the fact that rheumatic disease, especially in children, can produce abdominal symptoms. According to the latter observers, with the exception of dietary indiscretions rheumatism is the most important cause of minor abdominal symptoms in children. These may be acute or chronic. In the former, the pain begins in the upper abdomen, does not radiate, and is frequently associated with vomiting. According to Wolffe and Brim, a carefully taken history will usually reveal the presence of an antecedent epistaxis, thigh or calf pain. Whereas muscle spasm usually accompanies acute abdominal disease, it is infrequent in acute rheumatic fever and when present is voluntary.[39]

Malaria frequently causes acute abdominal manifestations. These consist of nausea, vomiting, fever, and abdominal pain. In our experience acute abdominal manifestations occur most frequently in cases of malaria which have been incompletely treated. Of diagnostic importance are the relative leucopenia, absence of abdominal rigidity, and higher temperature than is usually seen in acute abdominal conditions.

Because of involvement of the ileocecal lymph nodes and the Peyer's patches in the ileum during the course of scarlet fever, frequently there are abdominal manifestations in this condition. Brandman[41] is of the opinion, however, that if there is any question as regards diagnosis a laparotomy should be done, because although an unnecessary operation is undesirable during the presence of scarlet fever, it is far better to perform a laparotomy rather than to overlook an acute suppurative process in the appendix.

Cases of heavy metal poisoning often are admitted to the hospital with symptoms appearing which apparently require immediate surgical intervention for relief. Fisher[42] reports four cases of heavy metal poisoning with clinical manifestation of an acute abdominal lesion in which a diagnosis was not made until autopsy. Provisional diagnosis in these cases are usually acute appendicitis, ruptured peptic ulcer, acute pancreatitis, acute cholecystitis, kidney stones, intestinal obstruction, empyema of the gall-bladder, coronary thrombosis, and acute gastroenteritis. Of differential diagnostic importance, according to Fisher, are the facts that the patient has no fever and the abdomen is not distended. In such cases an intensive study of the vomitus, stool, urine, and blood is indicated. In every individual with abdominal colic careful examinations of the gums should be made in order to rule out the possibility of lead poisoning, as in this way, particularly if the patient's occupation is one that requires working with lead, a needless operation can be saved.

Occasionally, in excessive smokers, abdominal pain, anorexia, nausea, and vomiting are complained of. These manifestations are seldom suggestive of an acute abdominal catastrophe, but usually simulate those of a chronic lesion. Cessation of smoking will result in relief of all symptoms.

Arachnoidism, particularly that caused by the bite of the black widow spider, is associated with symptoms which closely resemble an acute inflammatory process within the abdomen. These symptoms consist of severe abdominal pain and marked muscle rigidity. As emphasized by Comroe[43] and Noland,[44] the rigidity, which is not associated with abdominal tenderness, is not limited to the abdomen, but also occurs in other parts of the body. The elicitation of an insect bite is of great importance. Many patients suffering from arachnoidism have been unnecessarily subjected to laparotomies which could easily have been avoided by a careful history and physical examination.

Campbell[45] has called attention to the fact that patients with sickle-cell anemia present evidence of acute abdominal disease, which may be confused with acute cholecystitis, acute appendicitis, acute salpingitis, peptic ulcer, and splenic infarcts. The pain is not infrequently cramp-like, and is either localized in the epigastrium or generalized, associated with nausea and vomiting, obstipation, and distention. Of great importance from a diagnostic standpoint is that sickle-cell anemia occurs almost entirely in the Negro race.

Other systemic conditions which occasionally give rise to abdominal manifestations are syphilis, measles, typhus, typhoid,

undulant and paratyphoid fevers, septicemia, Banti's disease, and hemolytic icterus. In each instance a careful physical examination and laboratory investigation usually will reveal the true cause of the manifestations.

GASTROINTESTINAL

Gastro-enteric lesions other than those which usually are considered of surgical importance can produce abdominal symptoms.

Amebic infections of the colon, particularly if limited to the right half of the large bowel, produce symptoms not dissimilar to those of chronic appendicitis and peptic ulcer. Indefinite abdominal pain most marked in the right lower quadrant with persistent tenderness over Lanz's or McBurney's points associated with nausea, anorexia, and loss of weight resulting from a cecal amebiasis is frequently mistaken for subacute appendicitis. In such instances careful examination of the stool will reveal the presence of E. histolytica (Ochsner[46]). The importance of making a correct diagnosis in such a case is evidenced by the fact that, whereas patients with chronic amebic lesions of the bowel stand operations fairly well, the handling of an acutely inflamed bowel, the result of amebic involvement, is a dangerous procedure. In all probability, many of the cases with right abdominal manifestations have an actual involvement of the appendix by the amebae. In such instances, however, the use of amebicides will result in a cure, thus obviating the necessity of an operation. Similarly, amebic involvement of the liver will produce symptoms referable to the gall-bladder and liver, and, if unassociated with acute colonic manifestations of amebiasis, are likely to be confused with cholecystitis. The presence of an enlarged, tender liver, low grade fever, and other vague abdominal manifestations mentioned above are likely to cause the inexperienced investigator to arrive at a wrong diagnosis (Ochsner and DeBakey[47]). Bacillary dysentery may also produce abdominal symptoms which can be confused with acute abdominal surgical conditions. In such instances the acute abdominal manifestations are usually the result of extensive involvement of the bowel and occasionally of extension of the inflammatory process to the peritoneum.

Regional ileitis is frequently confused with appendicitis and intestinal obstruction because it is an inflammatory lesion producing obstruction of the terminal ileum. Although it does not occur frequently, it should always be kept in mind, since if not recognized and treated at the time of the operation it may cause disastrous results.

Colonic diverticulitis can produce symptoms of left-sided appendicitis or peritonitis. Unless some complication requiring operative relief, such as abscess formation, stenosis, etc., is present, ultra-conservatism should be used in the treatment of diverticulitis.

Obstructions of the gastrointestinal tract can occur without any apparent reason for their development. Of all the causes of intestinal obstruction, external hernias are by far the most frequent. In such a case the diagnosis is usually not difficult because of the presence of the hernia. Internal herniation into one of the peritoneal folds or fossae is much more difficult to diagnose. The presence of peritoneal adhesions, the result of a previous operation or an inflammatory process, predisposes to an obstruction of the movable small bowel. In a child intussusception is the most frequent cause of obstruction and is relatively easily diagnosed if the condition is considered. It occurs most frequently in infants between five and twelve months of age and represents a surgical emergency. Intussusception in adults occurs infrequently and is almost invariably caused by a pedunculated intra-intestinal tumor, either a neoplasm or an inverted Meckel's diverticulum. In such a case the intussusception is caused by invagination of the bowel to which the tumor is attached into the distal related portion of the bowel during a peristaltic rush. The invagination not infrequently reduces spontaneously, only to recur at a subsequent date. The urgency of operation in such a case is not as great as in an infant in which spontaneous reduction is much less likely to occur.

Relatively rarely symptoms of intestinal obstruction occur as the result of spastic ileus, a condition in which the bowel becomes tonically contracted, actually producing incomplete obstruction in the involved portion. According to Henle,[48] who observed two cases, the spasm of the bowel is due to an increased irritability of the vegetative nervous system which is either constitutional or due to disturbances of the central nervous system. Zimmerman[49] collected 157 cases of spastic ileus in which the diagnosis was confirmed either by operation or by autopsy. He also observed two such cases. Forty-seven of the 159 patients (31.6 per cent) died. A fatal case of spastic ileus was reported by Schmid.[50]

One of us (A. O.) observed a case of spastic ileus in which the diagnosis was verified at operation. A woman, 42 years of age, had had recurrent attacks of generalized, colicky abdominal pain associated with nausea, vomiting, obstipation, and abdominal distention. A previous laparotomy failed to reveal any cause for the symptoms. During a severe attack in which the symptoms were

those of a mechanical intestinal obstruction, and because of a possible adhesions ileus (the result of a previous laparotomy), another laparotomy was performed. The terminal ileum over a distance of approximately 14 cm. was tonically contracted, relatively bloodless, and when handled could be bent with difficulty. The bowel proximal to it was distended and filled with fluid and gas. After applying hot compresses to the spastic segment for several minutes it became relaxed and the secretions proximal to the area passed into the cecum.

Melena is usually indicative of an ulcerative process in the gastrointestinal tract, either a benign or a malignant one. However, hemorrhage can occur from rupture of esophageal varices in portal cirrhosis. Frank intestinal hemorrhage is occasionally encountered in cases of cholecystitis and in which there is no evident lesion of the stomach or intestine. Lichtman[51] emphasized that biliary tract disease not associated with jaundice can be complicated by intestinal hemorrhage. The authors have recently observed a patient who had three massive intestinal hemorrhages, each one almost exsanguinating him. Careful examination of the gastrointestinal tract preoperatively revealed no evidence of a tumor or ulcer. Thorough exploration at laparotomy of the entire intestinal tract from the cardia to the rectum revealed no evidence of disease. Because of the marked cholecystitis and hepatitis a cholecystectomy was done, which completely relieved the patient of her symptoms.

Intestinal parasites, which are particularly likely to occur in young children, give rise to abdominal symptoms indistinguishable from those produced by infections of the appendix. Occasionally the presence of the parasites within the appendix produces the symptoms; in others, the presence of the parasites in the small and large bowel gives rise to the abdominal manifestations. Careful stool examination will reveal the correct condition and following the use of vermifuges the clinical manifestations will subside, thus obviating the necessity of a needless operation.

CEREBROSPINAL

Lesions of the cerebrum frequently give rise to abdominal symptoms which are confused with acute abdominal conditions. Wechsler[52] cites three cases with cerebral lesions in which there were abdominal manifestations. One, a boy with an epidural abscess of the frontal lobe, presented a clinical picture of acute appendicitis. The second, a girl with an intrapontile tumor, complained of intra-abdominal pain. The third, a young man with a hemangioblastoma of the cerebellum,

had recurrent attacks of abdominal pain. Emotional upsets, according to Alvarez and Henshaw[53] frequently are associated with severe abdominal pain. The abdominal manifestations differ from those produced by lesions of the abdominal viscera in that there is no relation to the digestive cycle, defecation, urination, menstruation, or bodily exertion. The location of the pain is also inconstant and migrates from one part of the abdomen to another.

Because the gastric crises of tabes dorsalis are associated with severe abdominal pain, a diagnosis of visceral perforation is frequently made and many laparotomies have been performed unnecessarily. Complete examination of the patient, including careful investigation of the pupillary and the tendon reflexes, facilitates the making of a correct diagnosis.

Herpes zoster produces severe abdominal pain, the pain frequently preceding the eruption by a number of days, making the differential diagnosis extremely difficult. Young[54] reports four cases in which differential diagnoses between herpes zoster and intra-abdominal lesions were particularly difficult. It is likely to be mistaken for appendicitis, cholecystitis, and renal disease.

Kiefer[55] has emphasized that other inflammatory lesions of the spinal nerves, such as spinal arachnoiditis, will produce abdominal manifestations. Arachnoiditis is characterized by thickness of the arachnoid membrane and the formation of adhesions which produce an irritation of the posterior root. In Kiefer's experience arachnoiditis produced abdominal manifestations resembling cholecystitis in one case, and appendicitis in two other cases. In another patient the pressure of a neurofibroma on the spinal cord produced symptoms referable to the gall-bladder. Kiefer states that abdominal pain produced by spinal lesions should be suspected when the pain persists in a definite location over a long period of time; when it is aggravated by sneezing and coughing; when associated with pain of the lower back or lower extremities, and when increased by change in position. Other spinal lesions which produce symptoms are intercostal neuralgia, cord neoplasia, transverse myelitis, and anterior poliomyelitis.

SKELETAL

In all cases with abdominal pain careful examination of the vertebral column is extremely important, because curvature of the spine and compression on the intercostal and other spinal nerves will result in pain which is referred to the abdomen and associated with tenderness. In cases with abdominal pain associated with tenderness

it is important, as suggested by Hembrow,[56] to differentiate between spinal nerve irritation with referred pain and hyperesthesia of the abdominal wall from an intra-abdominal lesion. This can be done very well by Carnett's tensed muscle test, which consists of raising the head or feet while the patient is in the supine position, causing the abdominal muscles to become tense. If tenderness persists, it is indicative of an extra-abdominal lesion. If it disappears, it suggests that the lesion is within the abdomen.

Tuberculosis of the spine by causing pressure on the posterior roots of the spinal nerves can produce referred abdominal pain. The detection of spinal tenderness or a gibbus is important, because tuberculous spondylitis frequently is accompanied by fever, and is likely to be mistaken for an acute suppurative intra-abdominal lesion.

Clinical evidences of peritonitis, including abdominal distention, nausea, and vomiting, and cessation of intestinal movement can be caused by irritation of the splanchnics in the retropleural space either as a result of involvement by an inflammatory process extending from a pneumonia or following injury to the spine or lower ribs. Similarly splanchnic irritation with its consequent abdominal manifestations can occur following plastic operations on the lower and paravertebral portions of the thorax. Other lesions of the vertebra, such as metastasis from mammary carcinoma and multiple myeloma, can produce pressure on the spinal nerve with abdominal manifestations (Alvarez[57]).

MUSCULAR

Defects in the abdominal wall (hernia) can produce gastrointestinal manifestations which vary from evidences of peptic ulcer to complete intestinal obstruction. If the hernia is in the inguinal region, it is less likely to be overlooked, but an epigastric or a diaphragmatic hernia is frequently not detected. Every patient with symptoms referable to the stomach or duodenum should have a careful examination of the linea alba above the umbilicus in order to verify or eliminate the possibility of a small epigastric hernia. At times the symptoms are indistinguishable from those of peptic ulcer, the lesion being due to incarceration of the peritoneum and the round ligament in the hernia. Recently we observed a case of a young girl aged 13, who one year previously had had an appendectomy through a McBurney incision. Following the operation she complained of considerable pain in the scar, so marked that she limped on her right side. The scar was exquisitely tender. The

abdominal scar was excised, and a defect was found in the transversalis fascia through which the parietal peritoneum had herniated. The peritoneum was replaced and the transversalis and external oblique fasciae were carefully approximated. The patient has remained symptom-free since the operation. Diaphragmatic hernias produce symptoms referable to the stomach and the gall-bladder, so that many patients with diaphragmatic hernias have had unnecessary cholecystectomies. Trichinosis, fibromyositis, and external trauma to the abdominal musculature can produce intra-abdominal symptoms referable to the intra-abdominal viscera which may be very confusing.

ENDOCRINIC

Endocrine imbalance frequently produces symptoms referable to the abdomen, which may be quite confusing unless the real cause of the trouble is recognized. Lester[58] investigated a number of cases in which a diagnosis of chronic appendicitis had been made, but in which unsatisfactory results were obtained by appendectomy. He found that in many the failures were due to undiagnosed endocrine disorders. Patients with hypothyroidism frequently complain of pain in the lower abdomen, usually on the right side. In women the pain is likely to precede the menstrual period. The duration of the pain lasts from a few to several days. This is likely to be mistaken for chronic appendicitis, particularly when there is associated gastric disturbance or constipation. Very little is found on physical examination except an indefinite tenderness. Subnormal temperature, a low blood pressure, dry skin, and cold extremities should arouse one's suspicion of the true condition. Dorff[59] observed a 6 year old boy with marked abdominal distention which was thought to be due to congenital megacolon. Because, however, of the findings of dwarfism, anemia, retarded osseous development, and atonic intestinal tract, a diagnosis of hypothyroidism was made. Following the institution of thyroid therapy the symptoms rapidly subsided.

Overactivity of the thyroid gland is frequently associated with gastro-intestinal manifestations, either constipation or diarrhea, and vague abdominal symptoms. McEachern[60] is of the opinion that abdominal symptoms in thyrotoxicosis are due to fermentation of imperfectly digested food. As a result of increased metabolism there is a greater demand for more fuel, resulting in the food being hurried through the small intestine into the cecum, where it arrives imperfectly digested. Robertson, Wohl, and Robertson[61] report three cases of hyperthyroidism in which the condition was masked

by symptoms of acute abdominal lesions. In two the signs were those of acute appendicitis. One of these was operated upon and the appendix found to be normal. In the third patient the pain was localized in the left upper abdomen. Post-mortem examination, however, showed no lesion within the abdomen to account for the symptom.

Ovarian disease or ovarian dysfunction can produce abdominal manifestations. Tubo-ovarian abscesses, because they are located within the abdomen, obviously produce symptoms of localized peritonitis, usually associated with vaginal discharge. Unruptured ovarian follicles can cause acute abdominal manifestations which are likely to be mistaken for appendicitis. As emphasized by Lester,[58] the pain in such cases is usually of sudden onset and frequently associated with nausea and vomiting. Tenderness, rigidity, fever, and leucocytosis are usually present. Of great importance in the differential diagnosis is a history of menstrual disturbance and the association of swollen, painful breasts during menstruation. The pain remains localized in the lower abdomen and usually disappears within twelve hours. Usually just before the attack a cystic mass can be felt in the involved ovary, which, however, disappears following the subsidence of the manifestations.

Pituitary disease has been known to cause abdominal pain. According to Musser,[62] hypophyseal substance injected into the cerebral ventricles causes gastric hypermotility, pylorospasm, and reverse peristalsis.

Other endocrinic disturbances also produce acute abdominal symptoms. Suprarenal insufficiency in Addison's disease can produce gastrointestinal manifestations because of weakness of the intestinal musculature. Parathyroid imbalance can cause abdominal symptoms in one of two ways: (1) in osteitis fibrosa cystica there may be compression of the spinal nerves following destruction of the vertebral bodies, and (2) tetany.

The onset of diabetic acidosis is frequently accompanied by abdominal pain, and many patients are operated upon without the true condition being recognized preoperatively. Although the administration of an anesthetic and the performance of an operative procedure unnecessarily may be of little prognostic significance in many extra-abdominal conditions producing abdominal symptoms, in the patient with diabetic acidosis either one or both of these procedures may precipitate a tragic result. Beardwood[63] studied 114 cases of diabetic acidosis in the majority of which the onset was accompanied by symptoms referable to the gastrointestinal

tract. Bothe and Beardwood[64] found that in 74 per cent of 136 patients with diabetic acidosis the predominating symptoms were nausea, vomiting, or abdominal pain. Among the admitting diagnoses were intestinal obstruction, acute cholecystitis, acute appendicitis, peritonitis, and acute pancreatitis. Beardwood is of the opinion that gastrointestinal manifestations of diabetic acidosis are more likely to develop in younger subjects. There is no relationship to duration or severity of the disease. The association of fever and leucocytosis is often present to complicate the picture further. Beardwood concludes that when nausea, vomiting, and abdominal pain occur in a diabetic patient, acidosis should be considered first, and because this disease is increasing in incidence, it should be suspected in every case presenting symptoms of an acute abdomen. Although an acute intra-abdominal suppurative process in a diabetic should be treated energetically, in the presence of ketonuria, as emphasized by Boettiger,[65] the acidosis should be combated first. Frequently the operative procedure becomes unnecessary (if the abdominal symptoms are the result of the acidosis), and in cases in which in addition to the acidosis there is an intra-abdominal surgical lesion the patient becomes a much better operative risk when the acidosis has been overcome. The clinical picture of diabetic acidosis in children is quite similar to that of acute appendicitis. In the former, however, vomiting usually precedes the pain[43] and drowsiness is much more frequently encountered.[66]

ALLERGIC

Acute, subacute, and chronic abdominal symptoms can be produced by allergic reactions and in many instances unwarranted surgical procedures have been performed. Dutton[67] reported 150 cases of allergy in which abdominal symptoms were present. Of this group forty-seven patients had had operations without permanent relief. Among the suspected conditions were acute and chronic appendicitis, peptic ulcer, cholecystitis, renal colic, and intestinal obstruction.

The exact cause of the abdominal manifestations is not known, but in all probability, as emphasized by Fries and Merrill,[68] in most if not all instances there are actual lesions in the abdominal viscera. This has been confirmed by the discovery of local areas of edema or giant urticaria on the bowel wall. Actual lesions can occur in the intestinal tract as the result of allergic sensitivity, as exemplified by two cases operated upon by Kaijser.[69] Both cases had had malarial treatment for syphilis and were being given a course of

salvarsan. Acute abdominal manifestations appeared and a diagnosis of ileus was made in one and appendicitis in the other. Edema and swelling of the intestine were found at operation, and in the second case were so marked that rupture of the intestine occurred when an attempt was made to replace it within the abdomen. The resected bowel was markedly thickened, edematous, and showed extensive infiltration with eosinophilic leucocytes. In a third patient with peptic ulcer symptoms, a partial gastrectomy was done. The resected stomach showed edema of the submucosa and infiltration with eosinophilic leucocytes. Subsequently a history of previous allergic symptoms was obtained.

Ryle has called attention to the fact that an inflammation of the appendix or the gall-bladder may act as a "sensitizer" in a patient with allergic tendencies. The association of cutaneous manifestations alone, therefore, should never exclude a more organic basis for attacks of abdominal pain. An eosinophilia and a favorable response to adrenalin during the attack may prove helpful in reaching a decision. Kaijser[69] advocates conservative therapy in such cases using adrenalin and calcium either preoperatively or at least before resorting to resection of the stomach or bowel.

Migraine is occasionally associated with abdominal crises and not infrequently nausea and vomiting occur. Blitzsten and Brams[71] have observed thirty-two cases of migraine in which the abdominal symptoms dominated the clinical picture. The clinical manifestations usually consisted of severe boring or cutting epigastric pain which was unrelieved by alkalies or food ingestion. There was slight muscular rigidity, but no fever. Of importance was the disappearance of the hemicrania with the onset of the abdominal manifestations. Five of the last ten observed cases were operated upon and nothing was found.

LYMPHATIC

Acute mesenteric lymphadenitis is a frequent cause of abdominal manifestations, especially in children, in whom it is particularly difficult to differentiate from appendicitis. In our experience, of diagnostic importance is the presence of tenderness along the root of the mesentery, i.e., on a line extending from McBurney's point upward and to the left, passing just above the umbilicus. Short[9] explains the occurrence of the acute pain on the basis of investigations by Kiss[72] in which it was shown that the splanchnic fibers actually traverse the mesenteric lymph glands. A wave of peristalsis, painless in itself, pulls upon the mesentery and the inflamed or

calcareous gland between its leaves, and irritates the nerve fibers passing through or close by. When the wave passes, the pain ceases. In our clinic sixty-five cases with mesenteric lymphadenitis were carefully studied.[73] In this series it was found that the condition was frequently confused with acute, subacute, and chronic appendicitis.

Of importance in the differential diagnosis between appendicitis and mesenteric lymphadenitis, in addition to mesenteric root tenderness described above, are relatively higher temperature and greater leucocytosis in mesenteric lymphadenitis. Whereas a diagnosis of mesenteric lymphadenitis is justified in children presenting a clinical picture of acute appendicitis and having tenderness along the root of the mesentery, it is our opinion that appendectomy should be done. In many instances there is an associated appendicitis which is the cause of the mesenteric lymphadenitis. Short[9] found mesenteric lymphadenitis in 6 per cent of school children in whom a diagnosis of acute appendicitis was made.

Thirteen of fifteen young adults reported by Allen and Howe,[74] in whom at the time of appendectomy calcified mesenteric lymph nodes were removed, were relieved of their symptoms, whereas of twenty-four with simple appendectomy thirteen continued to have the same abdominal discomfort for which the original operation was undertaken. These investigators believe that such cases should be recalled for further radical measures. They are likely to be branded as neurotics when in reality they have just cause for complaint.

Enlargement of the mesenteric nodes as the result of Hodgkin's disease occasionally produces acute abdominal pain. Thrombolymphangitis of the thoracic duct is extremely rare, but may simulate an acute abdominal surgical lesion. Poloyes[75] collected seventeen cases and reported one of his own.

NEOPLASTIC

Involvement of any of the abdominal viscera or vertebrae by neoplasms is likely to produce abdominal symptoms, yet in many cases of carcinoma of the stomach, particularly if not located at the pylorus, there are no symptoms until the lesion is far advanced.

As emphasized by Bourne,[76] pain may be the only manifestation of pancreatic carcinoma, and this usually has definite characteristics. It is constant, deep-seated in the abdomen, and may radiate to the back. It is likely to suggest disease of the vertebrae, or that affecting the sensory roots of the spinal cord. The pain has no relation to

food, but may affect posture, the patient obtaining some ease by assuming a huddled sitting posture. The absence of definite physical findings and the lack of positive roentgenologic characteristics are likely to lead to the conclusion that the pain is not founded upon an organic basis.

CONCLUSIONS

Despite these many pitfalls which lie in the path of the diagnostician, however, there is no reason for pessimism. These misleading factors should give no serious trouble to men with clinical experience and who examine the patient. The mimicry of disease is never perfect, although it frequently deceives the unwary, particularly if a thorough search is not made.

Even though the pain be referred, all should be familiar with the usual locations of this manifestation produced by intra-abdominal disease. There rarely ever exists disease of one part without general signs and symptoms, and the specialist who primarily remains a general practitioner is less likely to err in his diagnosis.

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